Section # and Title: Entire Report

Page #:

Sub-section title:

Paragraph:

Sentence:

Statement:

Comment: An overall impression of the report is that it presents a lot of useful information and draws apparently valid conclusions for most topics but it is not a finished product. Some sections of the report are repetitive and there is a need for improved integration of some topics.

Section # and Title: Entire Report

Page #:

Sub-section title:

Paragraph:

Sentence:

Statement:

Comment: The use of references throughout the text contains errors such as: a) references cited in the text do not appear in the reference section; b) the year cited in the text does not match the year cited in the reference section; and c) some references in the reference section are not referred to in the text, etc. Some specific errors are: Pg 56: Include reference for Abel and Blitzke, 1992 (pg 24), complete the reference for AQUIRE, 1998 Pg 57: Bio/Dynamics is cited as Biodynamics in text Pg 58: CAL-EPA 1998a is referred to in text as CAL-EPA Pg 59: Complete the reference for HEI; 1996 Pg 61: There are 2 NSTC, 1997 references. One should be 1997a; the other 1997b. Pg 62: Savolainen, 1995 is cited at 1985 in text (pg 21); Soffritti 1989 is cited as 1998 in text (pg 24); Taskinen, 1994 is cited as 1984 in text (pg 23). Pg 63: Include a reference for Zogorski et al., 1996

Section # and Title: Entire Report

Page #:

Sub-section title:

Paragraph:

Sentence:

Statement:

Comment: The document lacks a consistent use of units for air concentrations, and this also applies for water concentrations. This creates confusion in the narrative text. In several instances where exposure assessments are under discussion, the authors do not make clear whether they are referring to air or water exposures (e.g., inhalation or ingestion), and the use of units such as ppb (which can apply to both air and water) does not help to clarify this issue. A single unit such as ug/L should be used to refer to all water concentrations and units of ug/m^3 or ppbV should be used to refer to all air concentrations.

Section # and Title:	1. Executive Summary, Recommendations, Summary
Page #:	11
Sub-section title:	
Paragraph:	5
Sentence:	5
Statement:	*There is no statistically significant difference in the emissions reduction of benzene between oxygenated and non-oxygenated RFGs that meet all other CaRFG2 standards.*
Comment:	Is benzene the only contaminant of concern?

Section # and Title:	1. Executive Summary, Recommendations, Summary
Sub-section:	Executive Summary
Page #:	12
Title:	
Paragraph:	1
Sentence:	Last 3 sentences
Statement:	*Since both groundwater wells and surface water reservoirs have been contaminated, alternative water supplies may not be an option for many water utilities.* ***If MTBE continues to be used at current levels and more sources become contaminated, the potential for regional degradation of water resources, especially groundwater basins, will increase. Severity of water shortages during drought years will be exacerbated.***
Comment:	Monitoring of water-supply wells and surface water reservoirs for MTBE in California is incomplete ***and*** few community water-supply wells have been found to contain MTBE at levels above 5 μg/L. Additionally, there is little evidence presented in the report that regional degradation of water resources would result from continued MTBE use.

Section # and Title:	1. Executive Summary, Recommendations, Summary
Sub-section:	Executive Summary
Page #:	12
Title:	
Paragraph:	3
Sentence:	Last sentence
Statement:	W*e believe that the use of either non-oxygenated reformulated gasoline or ethanol as an oxygenate in CaRFG2 would result in much lower risk to water supplies, lower water treatment costs in the event of a spill of either of these alternative RFG formulations, and lower monitoring costs.*
Comment:	Little is known about the risk to water supplies of ethanol RFG or CaRFG2. Comprehensive information on the behavior and fate of ethanol and how it may influence BTEX behavior remains to be examined. A recent study by Corseuil and others (1998) suggests that ethanol could have a negative effect on passive bioremediation of BTEX.

Reference**:** Corseuil, H.X., Hunt, C.S., Dos Santos, R.C.F., and Alvarez, P.J.J., 1998, The influence of the gasoline oxygenate ethanol on aerobic and anaerobic BTX biodegradation: Water Research, vol. 32, no. 7, pp. 2065-2072.

Section # and Title:	Summary
Page #:	15
Sub-section title:	I. Background
Paragraph:	3
Sentence:	5

Statement: *Oxygenates are organic molecules that contain oxygen. Oxygenates are typically alcohols (such as ethanol) or ethers (such as MTBE). The main purpose for adding oxygenates to fuels is to promote more efficient combustion under adverse conditions in the engine, such as cold starts or fuel-rich operations, when a substantial amount of fuel may escape the engine unburned. The extra oxygen in the fuel helps to convert carbon monoxide (CO, a product of incomplete combustion) to carbon dioxide. To a lesser extent, the extra fuel-bound oxygen may help to convert hydrocarbons, also formed as products of incomplete combustion, to carbon dioxide and water. Currently, the most widely used gasoline oxygenates in California are MTBE, ethanol, and tert-amyl methyl ether (TAME). In the San Francisco Bay Area in 1997, MTBE was found to constitute about 95% of the oxygenates used in gasoline (Kirchstetter et al., 1998a). Other oxygenates used to a much lesser extent include other ethers, such as ethyl tert-butyl ether (ETBE). In a few California markets, CaRFG2 is currently being marketed without added oxygenates.*

Comment: Hydrocarbons contain only hydrogen and oxygen. While combustion "by-products" do include some hydrocarbons which are formed in the combustion process, exhaust emissions also contain partially oxidized compounds as well as unburned fuel hydrocarbons. Oxygenate compounds facilitate the conversion of both types of compounds to carbon dioxide and water.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	20
Sub-section title:	
Paragraph:	1
Sentence:	3
Statement:	*Since a major alternative to MTBE is ethanol, this section also briefly summarizes the available information on health effects of this oxygenate and its relevant combustion byproducts acetaldehyde and peroxyacetylnitrate (PAN).*
Comment:	Suggest changing the wording from "on health effects of this oxygenate" to "on health effects from ethanol" to make it more clear which oxygenate is being discussed.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	20
Sub-section title:	3.1 Taste and Odor of MTBE-Contaminated Water
Paragraph:	2
Sentence:	second to last
Statement:	*The California Department of Health Services proposed a secondary maximum contaminant level (SMCL) for MTBE of 5 ppb based on available data of the observable detection thresholds.*
Comment:	Suggest changing wording from "observable detection thresholds" to "observable taste and odor detection thresholds". The 5 ppb SMCL for MTBE stated in this paragraph is different than the 35 ppb odor threshold for MTBE on page 18 of Volume II, paragraph 1. These different numbers should be reconciled or additional explanation provided.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	22
Sub-section title:	3.3 Acute Effects of MTBE
Paragraph:	top of page
Sentence:	6
Statement:	*Effects on mood may be important in light of the fact that for many subjects, 75ppm is above the odor detection threshold, and presence of an unpleasant odor may have mood effects that could be of concern in occupational settings.*
Comment:	Comment 1: Is Nihlen et al. 1998a or 1998b? Comment 2: The sentence states that "air quality during MTBE exposure was rated as poorer" but does not clearly specify as poorer compared to what.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	22
Sub-section title:	3.4 Increase in Asthma Due to MTBE
Paragraph:	1
Sentence:	first and last sentences
Statement:	*It is plausible that combustion products of MTBE could exacerbate or even cause asthma (Leikauf et al. 1995), but there have been no studies to date designed to address this issue…….. Therefore, there is little evidence at present either to implicate or to exonerate MTBE as a cause or exacerbating factor in asthma.*
Comment:	The first and last sentences appear to be contradictory.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	23
Sub-section title:	3.5 Neurotoxicity
Paragraph:	1
Sentence:	last sentence
Statement:	*This is the only known study designed specifically to measure CNS symptoms amongst occupationally exposed workers, however, in the absence of data on MTBE blood levels in these workers, it is not possible to determine the dose required to cause the effects observed.*
Comment:	Authors should consider adding a sentence that the effects observed in the tanker drivers could be due to exposure to the other 90% of constituents in gasoline besides MTBE.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	23
Sub-section title:	3.5 Neurotoxicity
Paragraph:	2
Sentence:	fifth sentence
Statement:	*Animal studies indicate that exposure to concentrations as high as 8000 ppm can cause symptoms of acute CNS depression that are transient and reversible.*
Comment:	What is the exposure route for the 8000 ppm concentration? Presumably the sentence should be re-phrased to "Animal studies indicate that inhalation exposure to concentrations…."

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	23
Sub-section title:	3.6 Reproductive and Developmental Effects of MTBE
Paragraph:	3
Sentence:	2
Statement:	Laboratory animal experiments have shown that when exposure occurs during pregnancy at extremely high exposure levels (2500 ppm or greater for 6 hours per day throughout the gestational period) there are maternal and fetal effects (Conaway et al 1985; Bio/dynamics 1984b,c; Tyl and Neeper-Bradley 1989; Bevan et al 1997).
Comment:	Editing needed: "when exposure occurs.." should be changed to "when inhalation exposure occurs".

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	24
Sub-section title:	3.6 Reproductive and Developmental Effects of MTBE
Paragraph:	2
Sentence:	3
Statement:	*In the rat, TBA was not teratogenic, but did reduce fetal weight, cause maternal toxicity, and increase postnatal lethality (Nelson et al. 1989; Abel and Belitzke 1992).*
Comment:	Abel and Belitzke (1992) is not in the reference section and should be added to the list of references.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	24
Sub-section title:	3.7 Carcinogenesis of MTBE
Paragraph:	6
Sentence:	first
Statement:	*Formaldehyde caused lymphatic cancers in Sprague-Dawley rats exposed orally (Sofritti et al., 1998); two other bioassays of formaldehyde in Wistar rats did not find evidence of carcinogenicity after oral exposure (Til et al., 1989; Tobe et al., 1989).*
Comment:	The reference Sofritti et al. (1998) given in the text is apparently listed as Sofritti et al. (1989) on page 62 in the reference section.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	25
Sub-section title:	3.8 Mechanisms of MTBE Carcinogenesis
Paragraph:	2
Sentence:	last
Statement:	*Of the products formed from MTBE metabolism in the body, mutagenic activity has been established only for formaldehyde.*
Comment:	The term "MTBE metabolism in the body" is not used with adequate definition. In particular, does this refer to metabolism in humans, rats, or mice? If the authors are assuming that this is all the same (which may not be the case), they should say so.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	27
Sub-section title:	3.9 Health Effects of MTBE Byproducts
Paragraph:	2
Sentence:	second
Statement:	*Animal studies indicate decreased sperm motility in both rats and mice exposed to 8000 ppm, 6 hours per day for 14 weeks.*
Comment:	Suggest changing "mice exposed to 8000 ppm, 6 hours..." to "mice exposed via inhalation to 8000 ppm MTBE, 6 hours…" Consider changing units for air concentrations throughout entire text from ppb or ppm to ug/m^3.

Section # and Title:	3. Human Health Effects of MTBE and Ethanol
Page #:	27
Sub-section title:	3.11 Research Recommendations
Paragraph:	5
Sentence:	first
Statement:	*The potential health effects associated with formaldehyde, a metabolite and combustion product, isobutene, a primary combustion product, and tertiary butyl alcohol are matters of concern and require further evaluation.*
Comment:	Suggest changing "a metabolite and combustion" to "a metabolite of MTBE and combustion..."

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Page #:	29
Sub-section title:	
Paragraph:	1
Sentence:	3
Statement:	*However, legislation in California has required that primary and secondary drinking water standards be in place by 1999 and 1998, respectively.*
Comment:	It would be useful if the purposes and applications of "primary and secondary standards" would be defined in this report.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Sub-section:	5.1 Surface Water
Page #:	29
Title:	
Paragraph:	5
Sentence:	4
Statement:	*"The largest number of waterbodies are located in San Francisco (45), Sacramento (33) ... regions"*
Comment:	It would be helpful to the reader to clarify how "regions" are defined--whether they refer to the geographic location of a water body within an area or the point of use of the water. For example, Hetch-Hetchy and other Sierra reservoirs are listed under the San Francisco region (in Volume IV, Section 2.0, page 9). This seems justifiable given where the water from these reservoirs is used, but would not seem justifiable based only on their location.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Sub-section:	5.1 Surface Water
Page #:	30
Title:	
Paragraph:	3-4
Sentence:	
Statement:	
Comment:	The presentation of "summary" data on the occurrence of MTBE in reservoirs is not well condensed. What can be concluded from the counts being presented? Also, some discussion should be included to characterize how representative the data set is of the state's total reservoirs. There is a related discussion in Volume II (Section 2.2.3, third paragraph, page 4) stating that "Surface water reservoirs with recreational boating have reported MTBE concentrations of 1 to 15 ppb, although concentrations near marinas and after organized boating or jet ski events can be considerably higher." The source of that information does not seem to be addressed in this summary, where the highest class of concentrations is >14ug/L. The discussion should be coordinated better. Also, the units used should be consistent. The summary uses ug/L while the body of the report (II, 2.2.3 and IV, 2.0) uses ppb.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Sub-section:	5.1 Surface Water
Page #:	30
Title:	
Paragraph:	3
Sentence:	3
Statement:	*"Our understanding of the environmental fate and transport, and sources of MTBE is primarily based on those waterbodies which were monitored extensively."*
Comment:	Why were those waterbodies "monitored extensively"? Does basing the author's understanding on this subset of the data base bias the results? Assuming that these reservoirs are representative of the whole population may not be correct. Author(s) seem to be selecting a sample solely on the volume of data available thereby possibly looking at the worst case scenario as the sample of the typical situation. Weren't more samples taken at these reservoirs because a problem had already been determined to exist (or was suspected)? What are the dependent variables that cause the problem to exist at these reservoirs? Are these variables representative of all sites?

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Sub-section:	5.1 Surface Water
Page #:	30
Title:	
Paragraph:	Last
Sentence:	5-9

Statement:

Presented in a slightly different manner, and to avoid an undue influence of those seven waterbodies which were extensively sampled, we tabulated the number of waterbodies with at least one measured concentration in excess of the detection limit, 5 mg/L and 14 mg/L. For these conditions, 56 (53%) of the 105 waterbodies did not contain measurable quantities of MTBE. The remaining 49 (47%) waterbodies were found to have MTBE at least once. Of those waterbodies with detectable MTBE, 26 (25% of total number with data) were found to contain MTBE at levels greater than 5 mg/L at least once. A total of 13 waterbodies showed a MTBE concentration of more than 14 mg/L in at least one sample.

Comment:

The count of waterbodies containing MTBE at levels greater than 5 µg/L at least once (n=26) and the count greater than 14 µg/L at least once (n=13) does not total 49 waterbodies. Presumably the count for 5 µg/L should be higher (n=36).

Also, this section does not have a discussion of the extent to which MTBE is contained in drinking water supplied from these reservoirs. MTBE levels in drinking water at the consumers tap may be different from ambient levels in reservoirs.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Sub-section:	5.2 Groundwater
Page #:	31
Title:	
Paragraph:	1
Sentence:	5
Statement:	*Closed sites are not considered to pose a hazard to public heath or to the use of the …*
Comment:	Add an "l" to heath to read health.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Page #:	31
Sub-section title:	
Paragraph:	4
Sentence:	3
Statement:	*In the cases where groundwater has been contaminated with BTEX (benzene, toluene, ethylbenzene and xylenes, common constituents of gasoline) compounds but not MTBE, the leak of BTEX either occurred before MTBE was added to gasoline, or insufficient time has elapsed for the MTBE to reach monitoring wells.*
Comment:	The authors need to describe the gasoline-release scenario that is being discussed. For example, is the leak a single release of gasoline containing MTBE or is it a release of conventional gasoline (i.e. no MTBE present in the gasoline) followed by a second release of gasoline that does contain MTBE? In the first case, MTBE might not be present in the monitoring well because it has already been transported past the monitoring well. In the second case, the release of conventional gasoline might have caused BTEX to reach the monitoring well and MTBE from the second release has either not been transported to the monitoring well yet or has already been transported past the monitoring well. The possibility that MTBE has already been transported passed the monitoring well should be considered by the authors for ease of review.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Page #:	32
Sub-section title:	5.2 Groundwater
Paragraph:	top of page 32
Sentence:	last sentence in section of the paragraph
Statement:	*These groundwater concentrations will likely increase in the future, as MTBE continues to migrate from existing sources.*
Comment:	Many current MTBE source zones might well already be in a sort of steady state, at least as regards to source strength. Thus, the maximum groundwater concentrations found in a plume will not likely increase at most sites, though local concentrations might increase as previously contaminated water reaches uncontaminated zones. Simply put, many plumes might get bigger, but the maximum concentrations will likely not increase.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Sub-section:	5.2 Ground Water
Page #:	32
Title:	
Paragraph:	2-4
Sentence:	All

Statement:

Data obtained through September 17, 1998 from CAL-DHS and submitted by Local Primacy Agencies were used to identify the public water systems that have been contaminated with detectable concentrations of MTBE. CAL-DHS identified 35 public drinking water wells that have reported MTBE contamination. This number of impacted wells constitutes 1.2% of all the public supply wells that were tested for MTBE and 0.3% of all public supply wells in counties where at least one well was tested. (That is, we exclude counties in which no public supply wells have been tested for MTBE.) The 35 wells constitutes 0.25% of all public water supply wells in California. As of September 17, 1998, 9.94% of the State's public water systems served by groundwater sources have been tested for MTBE and 21.47% of the public water system groundwater well have been tested for MTBE.

We consider the 1.2% an upper-bound estimate of statewide impacts on public water supply wells since some of these wells were presumably sampled preferentially because of their proximity to known fuel sources. Accordingly, the 0.3% can be considered a lower bound for public supply wells. Applying these same percentages, we estimate that between 29 and 128 of the State's 10,931 unsampled active public supply wells have been impacted by MTBE. Thus, the total public wells that may be contaminated currently with MTBE is estimated to be on the order of 60 to 160.

(Statement continued on next page)

Statement (cont.): *Applying 0.3% and 1.2% to the 464,621 private wells reported in California during the 1990 United States Census leads to a crude estimate of the number of private wells that have been impacted – on the order of 1,000 to 5,000 wells. These numbers could be underestimates, as the shallower depths of private wells commonly make them more vulnerable to contamination than public wells.*

Comment: The information on the frequency of detection of MTBE does not state the reporting level for MTBE water analysis and the assessment level used in the tallies. A common assessment level must be selected before analyses from varied sources with different lab reporting levels can be compiled. Assuming that this was not done, the reported frequency of detection may not be valid. The detection frequency of MTBE and other VOCs in water is known to increase as the analytical detection level (or the assessment level) is decreased.

Additionally, the projections made for public wells and private wells affected by MTBE may be questionable, if a common assessment level was not used.

Section # and Title:	5. Extent of Contamination of Drinking Water Supplies
Sub-section:	5.3 Conclusion
Page #:	32
Title:	
Paragraph:	4
Sentence:	All

Statement: *Contamination of wells, groundwater, and surface water has already been demonstrated. This will increase as more MTBE is introduced into the environment.*

Comment: The continued use of MTBE may not necessarily result in additional surface waters containing MTBE at excessive levels. MTBE levels in reservoirs appear to decline markedly after watercraft use ceases or when recreation recedes to a wintertime level.

The extent to which MTBE contamination in wells and ground water (>14 μg/L) increases with time will largely be dependent on the number of releases from pipelines, gasoline storage tanks, refueling station spills, homeowner spills, auto accident gas spills, and so forth. Whether such releases will decrease, or stay the same should be discussed in more detail in the report, and, in part, be used to estimate trends.

Section # and Title:	6. Exposure Assessment
Page #:	32
Sub-section title:	
Paragraph:	5
Sentence:	first and second
Statement:	*There are three most probable exposure routes for MTBE released into the environment. These include ambient air, surface water and groundwater.*
Comment:	The beginning of this section does not clearly indicate whether it is dealing with exposure routes to humans or with fate and transport of MTBE released into the environment. If it is dealing with exposure routes to humans, then the first two sentences should be re-written to state: "There are two most probable routes of human exposure to MTBE. These include inhalation and ingestion of drinking water." Drinking water can be obtained from either surface water or ground water sources. The paragraph can then go on to state why dermal exposure, incidental ingestion of soil, etc. are not considered as routes of human exposure in this document. The paragraph should be split into two paragraphs; one addressing human exposure routes to MTBE, the other addressing fate and transport of MTBE in the environment.

Volume # and Title:	1 Health & Environmental Assessment of MTBE
Section # and Title:	6.1 Sources, Fate, and Transport of MTBE
Page #:	33
Sub-section title:	6.1.2.1 Sources of MTBE
Paragraph:	3
Sentence:	7
Statement:	*Clearly, even this most unrealistic of cases fails to explains the observed concentrations in waterbodies.*
Comment:	The qualifier "some" is needed in front of "waterbodies". In other words, many waterbodies have low concentrations that would be consistent with 1-2 ug/L. It is only some waterbodies that have concentrations that are well above this level.

Section # and Title:	6.1 Sources, Fate, and Transport of MTBE
Page #:	34
Sub-section title:	6.1.2.1 Sources of MTBE
Paragraph:	2
Sentence:	last sentence in paragraph
Statement:	*Extensive lake monitoring by the UC Davis – Tahoe Research Group revealed no significant impact on Donner Lake; however, if Summit Creek were a drinking water supply, distribution would have been interrupted for a period as long as or greater than one month.*
Comment:	Very few creeks (in contrast to rivers) serve as water supplies, so at least from a drinking water perspective, this sentence may be making more of the potential problem than is warranted.

Section # and Title:	6.1 Sources, Fate, and Transport of MTBE
Sub-section:	6.1.2.1 Sources of MTBE
Page #:	33
Title:	
Paragraph:	3
Sentence:	Last two sentences
Statement:	*Second, the existing data bases which are extensive enough to cover an annual period show that MTBE is most likely to occur in higher concentrations in the late spring-summer-early fall. Because this is typically a period of minimal precipitation in California (i.e. dry summers) it is improbable that precipitation is of real consequence in explaining the concentrations of MTBE found in surface waterbodies*.
Comment:	The stated relevance of MTBE in precipitation (versus watercraft exhaust as the main source) to explain levels in reservoirs may be valid for the California environmental setting. However, the relative significance of precipitation scavenging, stormwater runoff, and watercraft exhaust has not been assessed elsewhere in the United States, in areas where RFG gasoline is used. The cited USGS study of MTBE in stormwater (i.e. Delzer et al., 1996) did not involve any MTBE RFG areas of the U.S. The level of MTBE in stormwater in CA and other MTBE RFG areas warrants investigation, especially in settings where stormwater is captured and recharged to ground water for future drinking water supplies, or where stormwater enters rivers that are used as a surface water supply.

Section # and Title:	6.1 Sources, Fate, and Transport of MTBE
Sub-section:	6.1.2.1 Sources of MTBE
Page #:	34
Title:	
Paragraph:	1
Sentence:	2-3

Statement: *If shallow groundwater contains elevated levels of MTBE from urban stormwater runoff as suggested by the USGS (Squillace et al., 1996) or if underground storage tanks have leaked into an aquifer, this could discharge into surface waters. At this time we were unable to find any documented evidence that this has occurred.*

Comment: Contaminated ground water containing elevated levels of MTBE has been demonstrated to enter surface water in 2 locations. In one case, a spring discharges MTBE and gasoline hydrocarbons (and other VOCs) to a small creek near Harrisburg, PA (Daly and Lindsey, 1996). In the second case, a gasoline release containing MTBE contaminated ground water has moved and is discharging to a drainage ditch which flows to a river. (Personal Communications, Jim Landmeyer, USGS, Columbia, SC, 1998).

Reference: Daly, M.H., and Lindsey, B.D., 1996, Occurrence and concentrations of volatile organic compounds in shallow ground water in the Lower Susquehanna River Basin, Pennsylvania and Maryland: U.S. Geological Survey Water-Resources Investigation Report, WRIR 96-4141, 8 p.

Section # and Title:	6.1 Sources, Fate, and Transport of MTBE
Sub-section:	6.1.2.1 Sources of MTBE
Page #:	34
Title:	
Paragraph:	3
Sentence:	1
Statement:	*Monitoring and research data from a number of independent sources all indicate that exhaust from motorized watercraft is the most significant source of MTBE to lakes and reservoirs.*
Comment:	The significance of watercraft exhaust as the "most significant source of MTBE" has not been evaluated comprehensively outside of California. The sentence would be more appropriately stated that "experience in California indicates . . . ", etc.

Section # and Title:	6.1 Sources, Fate, and Transport of MTBE
Page #:	35
Sub-section title:	6.1.2.2 MTBE Loss from Surface Waters
Paragraph:	6
Sentence:	4
Statement:	*While this rate of loss is dependent on a number of site-specific factors (e.g. bulk-phase concentrations, wind speed, temperature, lake hydrodynamics, etc.), the calculated 14-day half-life may be fairly applicable to describe MTBE loss from the surface waters when boat use is ended.*
Comment:	While a 14 day half-life might be generally applicable to Donner Lake, it will not be generally applicable to all ponds, lakes, and reservoirs. Indeed, the half-life will depend on several important variables, including the depth of the thermocline, the surface to volume ratio for the epilimnion, and the wind speed.

Section # and Title:	6.1 Sources, Fate, and Transport of MTBE
Page #:	36
Sub-section title:	6.1.2.3 Lake and Reservoir Modeling
Paragraph:	3
Sentence:	4
Statement:	*MTBE influx has been assumed to be a function….*
Comment:	The word "simulated" should be inserted in front of "MTBE". The values discussed are modeled values, and this should be made more clear.

Section # and Title:	6. Expose Assessment
Sub-section:	6.1.2.3 Lake and Reservoir Modeling
Page #:	36
Title:	
Paragraph:	4
Sentence:	4 & 5
Statement:	*Consequently, MTBE concentrations at depth are near zero, in agreement with measurements. Lake Perris, by contrast, displays higher concentrations at depth (5-10 ug/L) due to the mixing produced by inflow from a submerged pipeline."*
Comment:	Given the context of this statement, the text should specify that a water pipeline, not a fuel pipeline, is being referenced.

Section # and Title:	6.1.3 Groundwater
Page #:	37
Sub-section title:	6.1.3.1 Transport and Fate of MTBE in Groundwater
Paragraph:	1
Sentence:	
Statement:	*"Although MTBE has been shown to degrade in biologically active soils, evidence to date suggests that MTBE is not biodegrading appreciably in groundwater"*
Comment:	This sentence should be referenced if it is to be retained. Alternately it may be better to indicate that this is the case at least for anoxic aquifers.

Section # and Title:	6.1.3 Groundwater
Page #:	37
Sub-section title:	6.1.3.1 Transport and Fate of MTBE in Groundwater
Paragraph:	3
Sentence:	2

Statement: *Unlike petroleum hydrocarbons such as benzene, transport of MTBE does not appear to be limited appreciably due to sorption (i.e., temporary retention of the contaminant on soil and sediment particles) or biodegradation by native microorganisms*

Comment: MTBE is not as dissimilar to the BTEX compounds at this sentence suggests. While the BTEX compounds will be retarded somewhat relative to MTBE in subsurface systems that have perhaps 0.5% by weight organic carbon in the aquifer material, benzene will still move at about 45% of the velocity of MTBE (NTSC, 1997). Furthermore, sand and gravel aquifer materials frequently have less than 0.5% organic carbon and benzene in these aquifers will move at velocities closer to that of MTBE. For example, in the Borden aquifer (which has a low organic carbon content) benzene is predicted to move at approximately 84% of the velocity of MTBE (NTSC, 1997).

Reference: NSTC (1997). Interagency Assessment of Oxygenated Fuels. National Science and Technology Council (NSTC), Committee on Environment and Natural Resources (CENR) and Interagency Oxygenated Fuels Assessment Steering Committee. White House Office of Science and Technology Policy (OSTP) through the CENR of the Executive Office of the President. Washington, D.C.: NSTC.

Section # and Title:	6.1.3 Groundwater
Page #:	37
Sub-section title:	6.1.3.1 Transport and Fate of MTBE in Groundwater
Paragraph:	1
Sentence:	last
Statement:	*Owing to MTBE's high solubility and rather large fraction in reformulated gasoline (~11% by volume), concentrations in groundwater can be very high, up to 6,000,000 (unintelligible units) (Zogorski et al., 1996; Happel et al., 1998).*
Comment:	The units on the 6,000,000 are unintelligible. Presumably, these are supposed to be ug/L. It should be pointed out that while a concentration approaching 6,000,000 ug/L would be possible for a small volume of water in equilibrium with a large volume of gasoline containing 10+% MTBE, concentrations this large have never been observed at actual gasoline contamination sites, even in spill source zones. The 6,000,000 value is not believed to be from Zogorski et al. Zogorski et al. (1996) does state the water solubility of MTBE from 10% MTBE RFG gasoline at room temperature to be 5,000,000 μg/L. This is a theoretical solubility limit and is not synonymous with measured ambient level. Measured levels to date are considerably below this solubility limit. Zogorski reference is not on the reference list on page 63.

Section # and Title:	6.1 Sources, Fate & Transport of MTBE
Sub-section:	6.1.2.3 Lake and Reservoir Modeling
Page #:	37
Title:	
Paragraph:	2
Sentence:	1 and 2
Statement:	*MTBE volatilization rates are generally higher in rivers and streams than for lakes. This is due to their shallow depth, rapid vertical mixing and high turbulence intensities. The model by Pankow et al., (1996) showed that MTBE in streams typically exhibits a half-life of hours to days.*
Comment:	The article by Pankow also states that larger rivers, especially slower deeper rivers can have very long half-lives. It may be appropriate to first characterize the typical stream/river situation in California (velocity, depth temperature) and then make a general statement on MTBE's half-life from Pankow et al. (1996).

Section # and Title:	6 Exposure Assessment
Page #:	37
Sub-section title:	6.1.3.2 Movement in groundwater and potential impact on water supply
Paragraph:	6
Sentence:	second
Statement:	*Thus, extrapolating on the basis of the estimated 0.3 percent and 1.2 percent (percentage of public supply sells known to be impacted by MTBE today), we estimate that the risk of public water supply wells being impacted could increase to between 1 percent and 5 percent (100 to 700 wells) by 2010.*
Comment:	Change "public supply sells" to "public supply wells".

Section # and Title:	6.1.3 Groundwater
Sub-section:	6.1.3.1 Transport and Fate of MTBE in Groundwater
Page #:	37
Title:	
Paragraph:	3
Sentence:	2, 3, and 4

Statement: *Unlike petroleum hydrocarbons such as benzene, transport of MTBE does not appear to be limited appreciably due to sorption (i.e., temporary retention of the contaminant on soil and sediment particles) or biodegradation by native microorganisms. Although MTBE has been shown to degrade in biologically active soils, evidence to date suggests that MTBE is not biodegrading appreciably in groundwater. Owing to MTBE's high solubility and rather large fraction in reformulated gasoline (~11% by volume), concentrations in groundwater can be very high, up to 6,000,000 (unintelligible units) (Zogorski, et al., 1996; Happel et al., 1998).*

Comment: Two recent studies suggest that MTBE can biodegrade naturally in ground water. Field studies in Canada (Schirmer and Barker, 1998) and North Carolina (Borden et al., 1997) have shown large removals of MTBE, however, long half-lifes were evident. To state that "MTBE is not biodegrading appreciably in groundwater" is not entirely descriptive of current scientific knowledge. In some settings, MTBE is partially or completely attenuated, however, the half life for such natural attenuation is much longer than BTEX compounds.

References: Borden R.C., and others, 1997, Intrinsic biodegradation of MTBE and BTEX in a gasoline contaminated aquifer: Water Resources Research, Vol. 33, no. 5, pp. 1105-1115.

Schirmer M., and Barker J.F., 1998, A study of long-term MTBE attenuation in the Borden Aquifer, Ontario, Canada: Ground Water Monitoring and Remediation, Spring 1998, pp. 113-122.

Section # and Title: 6 Exposure Assessment

Page #: 38

Sub-section title: 6.2.1 Urban Air Environments

Paragraph: 2

Sentence: first

Major or peripheral comment: major

Statement: *This exposure assessment includes exposure to indoor and outdoor ambient air, as well as exposure during refueling and while driving.*

Comment: The title of this section is misleading. It implies that the section deals just with inhalation exposures, but then goes on to discuss ingestion and dermal routes of exposure. The first sentence should be changed to "..assessment includes inhalation exposure to.."

Section # and Title:	6.2 Human Health Exposure
Page #:	38
Sub-section title:	6.2.1 Urban Air Environments
Paragraph:	
Sentence:	last sentence in paragraph
Statement:	*Although the dose during refueling is not high in absolute terms, in comparison with the dose during other activities, it is high in relative terms considering the rather small exposure time (a few minutes per week).*
Comment:	This sentence is confusing and perhaps contradictory. It first says that the dose during refueling is not high in absolute terms. The sentence goes on to say that the exposure during refueling is high in relative terms, considering the short exposure times. Why is a discussion of the exposure time needed? Are the authors just trying to say that the dose is not high in absolute terms, but compared to other doses, is it one of the bigger ones? This should be clarified.

Section # and Title:	6.2 Human Health Exposure
Page #:	38
Sub-section title:	6.2.2 Contaminated Water Supplies
Paragraph:	7
Sentence:	first
Statement:	*We performed a probabilistic analysis that allowed us to examine the associated uncertainty in the model and the sensitivity of the exposure to the parameters used in the analyses. Uncertainty analysis refers to a determination of the variation in exposure that results from the collective variation in model inputs.*
Comment:	This paragraph could begin by stating that both a deterministic and probabilistic exposure assessment were conducted. It could then go on to describe the deterministic assessment followed by the probabilistic assessment. Generally, deterministic assessments are conducted prior to conducting a probabilistic exposure assessment, so when the reader encounters the phrase "We performed a probabilistic analysis" it begs the question of why a deterministic analysis wasn't performed. A clear comparison of the results between the deterministic and probabilistic exposure assessments at the end of section 6.2.2 would be useful.

Section # and Title:	6.2 Human Health Exposure
Page #:	39
Sub-section title:	6.2.2 Contaminated Water Supplies
Paragraph:	Top
Sentence:	5
Statement:	*For the deterministic analyses, we used the arithmetic mean of the concentration of MTBE in the water column during the boating season.*
Comment:	This sentence follows a fairly lengthy discussion of both surface water and groundwater. Then, it focuses without any clear reason on surface water concentrations. The reason for this focus should be explained.

Section # and Title:	6.2 Human Health Exposure
Page #:	39
Sub-section title:	6.2.2 Contaminated Water Supplies
Paragraph:	1
Sentence:	last sentence in paragraph
Statement:	*Distributions used in the probabilistic assessment were obtained McKone and Bogen (1992).*
Comment:	The word "from" should be inserted in front of "McKone and Bogen (1992)".

Section # and Title:	6.2 Human Health Exposure
Page #:	39
Sub-section title:	6.2.2 Contaminated Water Supplies
Paragraph:	3 and 5
Sentence:	several

Statement:

The CAL-EPA draft Public Health Goal (CAL-EPA, 1998) proposed 14 ug/L as the concentration at which the increased risk of developing cancer from oral exposure is one in one million (1×10^{-6}). This concentration assumes both ingestion and inhalation exposure of MTBE originating in tap water. Based on PBPK modeling and CalTox simulations, it was estimated that the dose received from inhalation is approximately one-half of the dose from ingestion. MTBE entering the body through ingestion is assumed to be absorbed completely into the gastrointestinal tract, while 50% of the inhaled MTBE is assumed to be absorbed

Using Model I and the 14 ug/L draft Public Health Goal (PHG) MTBE concentration, we calculated the exposure as 6.8×10^{-4} mg/kg-d. This is the average daily exposure at which the increased risk of cancer would be 1×10^{-6}. Using this exposure level as the target, we then determined the concentration of MTBE in the water that would be necessary to generate that same exposure target using the assumptions of Model II.

Comment:

The reasoning here is not clear. This section of the document should refer to Volume V which describes the models more thoroughly. In general, section 6.2.2 is too long and its objective is to summarize the exposure assessment. A possible way to re-work those paragraphs might be as follows:

(Comment continued on next page)

Comment (cont.): "The CAL-EPA draft Public Health Goal (PHG) (CAL-EPA, 1998) proposed 14 ug/L as the concentration at which the increased risk of developing cancer from oral exposure is one in one million (1×10^{-6}). This concentration assumes both ingestion and inhalation exposure to MTBE originating in tap water. We performed two exposure scenarios using a model derived from McKone and Bogen (1992), each scenario using a different assumption for the amount of MTBE absorbed in the body through inhalation. In the first scenario, we calculated the total exposure via ingestion of drinking water and inhalation to be 6.8×10^{-4} mg/kg-day using the 14 ug/L draft PHG for the MTBE concentration. In the second scenario, we determined that the concentration of MTBE in the water resulting in an average daily exposure of 6.8×10^{-4} mg/kg-day is 10.1 ug/L, which is approximately 30% lower than the draft PHG standard."

Section # and Title:	6.2 Human Health Exposure
Page #:	39
Sub-section title:	6.2.2 Contaminated Water Supplies
Paragraph:	5
Sentence:	first
Statement:	*Using Model I and the 14 ug/L draft Public Health Goal (PHG) MTBE concentration, we calculated the exposure as 6.8 x 10^{-4} mg/kg-d. This is the average daily exposure at which the increased risk of cancer would be 1 x 10^{-6}. Using this exposure level as the target, we then determined the concentration of MTBE in the water that would be necessary to generate that same exposure target using the assumptions of Model II.*
Comment:	It would be helpful to state which exposure routes are included in the 6.8 x 10^{-4} number. Perhaps change sentence to "..we calculated total exposure including ingestion of drinking water and inhalation to be 6.8 x 10^{-4} mg/kg-d"

Section # and Title:	6. Expose Assessment
Sub-section:	6.2.2 Contaminated Water Supplies and 6.3 Ecological Risk Assessment
Page #:	38 and 40
Title:	
Paragraph:	1
Sentence:	
Statement:	*Page 38: Two lakes were selected as representative surface waters that supply drinking water in the state."* *Page 40: "Lake Perris and Donner Lake were selected as representative of aquatic ecosystems in the State."*
Comment:	The term "representative" as its used in these statements may not be appropriate without further description of the relevent characteristics of these two reservoirs in comparison to the characteristics of all other California reservoirs that supply drinking water. Instead, we suggest that these lakes might be better characterized as "examples" of surface waters that supply drinking water in the state. The description on page 36 (6.1.1.3) also seems appropriate: "These lakes [including Calereo] were chosen as they represent a broad range of geographical, climatological and limnological conditions".

Section # and Title:	6. Expose Assessment
Sub-section:	6.2.2 Contaminated Water Supplies
Page #:	39
Title:	
Paragraph:	3
Sentence:	
Statement:	*For the deterministic analyses, we used the arithmetic mean of the concentration of MTBE in the water column during the boating season.*
Comment:	It is not clear which analyses these are referring to as opposed to the "probabilistic analysis."

Section # and Title:	6.3 Ecological Risk Assessment
Page #:	40
Sub-section title:	
Paragraph:	4
Sentence:	last sentence in the paragraph
Statement:	*Hazard quotient values for MTBE were much lower than 1.0, indicating very little potential for adverse ecological effects.*
Comment:	It should be clarified for what water concentration are these calculations being made.

Section # and Title:	7.1 Cost of Water Treatment
Page #:	41
Sub-section title:	
Paragraph:	2
Sentence:	first
Statement:	*For this analysis, we considered the following two main scenarios: (1) high levels of MTBE contamination near the fuel tank, at concentrations ranging from 100 to 5000 ug/L, **which** need to be remediated to protect the aquifer if it is a potential drinking water source, but **which** are typically pumped at low (10gal/min) to medium (100 gal/min) flowrates; and (2) low levels of MTBE contamination in surface waters and in the vicinity of drinking water wells, at concentrations ranging from 5 to 100 ug/L, **which** process large (100-1000 gal/min) water flowrates.*
Comment:	The second and third of the "which"s are grammatically incorrect. The second "which" is intended to refer to ground water supply wells, but actually refers to "high levels of MTBE contamination." The third "which" is again intended to refer to supply wells, but actually refers to "low levels of MTBE contamination."

Section # and Title:	7.6 Conclusions and Recommendations
Page #:	46
Sub-section title:	
Paragraph:	4
Sentence:	several
Statement:	*Liquid-phase biofiltration is the lowest cost technology at flowrates of 100 gal/min and greater. Air stripping is the second lowest cost technology for high flowrates, if no air treatment is required. Given the nature of these feasibility cost estimates, it is recommended that specific vendor quotes be obtained for each site. Hollow fiber membranes are the lowest cost treatment for flowrates of 10 gal/min if no air treatment is required, which is typical at these low flowrates. GAC will be the most cost-effective technology for flowrates on the order of 10 gal/min if air treatment is required. AOP is in all cases more expensive than the alternative technologies, and there are sufficient uncertainties at this point with respect to byproducts of AOP to warrant further study of this technology. It has the potential of being cost-competitive at high flowrates, provided it is fully tested at the field scale.*
Comment:	USGS did not attempt to conduct a comprehensive review of the cost of alternative treatment technologies to remove MTBE from ground water. We did note the authors conclusion that liquid-phase biofiltration is the lowest cost technology at certain flowrates. Have there been adequate field trials of this technology to document its success (i.e. treatment performance) and its cost? If so, the authors may wish to incorporate appropriate references and discuss this field experience, as a basis for their assumptions related to biofiltration.

Section # and Title:	9. Cost Benefit Analysis of MTBE and Other Gasoline Alternatives
Sub-section:	9.2 Aggregate Cost of Water Treatment
Page #:	51
Title:	
Paragraph:	2
Sentence:	1 and 2
Statement:	*To estimate the aggregate annualized cost of water treatment, we compare the treatment of MTBE contaminated sites versus the same number of sites if conventional gasoline had still been used. The difference is important since approximately 80% of conventional gasoline leaks are dealt with natural attenuation, whereas we estimate that only 10% of MTBE/gasoline leaks can be naturally attenuated.*
Comment:	Is there a scientific basis for the statement that "only 10% of MTBE/gasoline leaks can be naturally attenuated?" If so, it should be cited. If not, several rates (10%, 25%, 50%, etc.) should be assessed and the importance of the rate on cost should be described.

Section # and Title:	9. Cost Benefit Analysis of MTBE and Other Gasoline Alternatives
Sub-section:	9.2 Aggregate Cost of Water Treatment
Page #:	52
Title:	
Paragraph:	2
Sentence:	1 and 2
Statement:	*A literature review indicates that the cost of using ethanol in terms of risk to the water supplies is low. Ethanol plumes will biodegrade fairly rapidly. Undocumented studies indicate that if ethanol and BTEX are present, the intrinsic microbial population will preferentially degrade ethanol rather than BTEX, potentially extending the length of the BTEX plume.*
Comment:	The rapid biodegradation of high levels of ethanol (from ethanol RFG) is not well demonstrated for varied hydrogeochemical settings. As such, characterizing ethanol's risk to water supplies as "low" may be incorrect. Also, has the presence of degradation products of ethanol been considered in your analysis? As noted previously, Corseuil and others (1998) have reported that ethanol's presence may have a negative effect on passive BTEX bioremediation.

Section # and Title:	9. Cost Benefit Analysis of MTBE and Other Gasoline Alternatives
Sub-section:	9.5 Monitoring Costs
Page #:	54
Title:	
Paragraph:	1
Sentence:	1 and 2
Statement:	*Monitoring for ethanol or toluene would likely be incorporated into the periodic sampling for volatile organic compounds that public water utilities perform and report to CAL-DHS. We consider that this cost would not be significant for ethanol-based gasoline formulations or non-oxygenated gasoline, relative to conventional gasoline.*
Comment:	Ethanol is too polar to be analyzed by the classical method used to measure VOCs in water (purge and trap, GC/MS). Also, it may be difficult to achieve low-level analyses of ethanol in water. Toluene is usually measured on VOCs schedules and MTBE can be measured on such schedules at little to no additional cost. Based on the above, ethanol RFG would have the largest monitoring cost since it will require a different/new analytical method. MTBE's monitoring cost appears to be overstated in the 1st paragraph of this section, especially in comparison to the cost of ethanol monitoring. Regardless of what gasoline is used, in-lake monitoring will have similar costs and the cost will be mostly associated with field costs including personnel and equipment costs.

Section # and Title:	9. Cost Benefit Analysis of MTBE and Other Gasoline Alternatives
Sub-section:	9.6 Recreational Costs
Page #:	54
Title:	
Paragraph:	3
Sentence:	1
Statement:	*Based on our preliminary estimate of the risk of using ethanol-based CaRFG2 or non-oxygenated gasoline, these formulations would probably not result in the need for boating restrictions for water-supply reservoirs.*
Comment:	We are not aware of scientific studies that document the behavior and fate of ethanol in reservoirs. The authors should provide citations to support their assumptions about the behavior and fate of alternative gasolines in reservoirs.

Section # and Title:	Executive Summary
Page #:	ix
Sub-section title:	Taste and Odor
Paragraph:	2
Sentence:	second
Statement:	*From a 57 member panel, individual detection limits ranged from 1.4 ppb to 132 ppb.*
Comment:	The authors should specify whether the individual detection limits are for taste or for odor.

Section # and Title:	2. Exposure Assessment
Page #:	2
Sub-section title:	2.1 Introduction
Paragraph:	4
Sentence:	1
Statement:	*Alternative fuel oxygenates include … and tert-amyl-butyl ether (TAME) (HEI 1996).*
Comment:	The correct chemical name for TAME is *tert*-amyl methyl ether.

Section # and Title:	2. Exposure Assessment
Page #:	4
Sub-section title:	2.2.3 Sources of Water Contamination
Paragraph:	3
Sentence:	3
Statement:	*Surface water reservoirs with recreational boating have reported MTBE concentrations of 1 to 15 ppb.*
Comment:	The discussion in this section appears to be inconsistent with the presentation of MTBE concentration results in another section of the report (Volume IV, MTBE in Surface Drinking Water Supplies, Section 2.0, page 3) that uses different thresholds (15 ppb vs. 14 ppb), leaving questions as to whether the two sections contradict each other. That same part of Volume IV, Section 3.1, page 26, also presents other concentration ranges (<1-20 ug/L). Please check to assure consistency between the different sections of the report.

Section # and Title:	2. Exposure Assessment
Page #:	4
Sub-section title:	2.2.4 Sources of Water Contamination
Paragraph:	1
Sentence:	
Statement:	
Comment:	How do the percentages of sampled water sources and detected concentrations presented here relate to those presented in Volume IV, Section 2.0 and in the Summary (Volume I, Section 5.1)? Can the various sections be tied together better?

Section # and Title:	2. Exposure Assessment
Page #:	9
Sub-section title:	2.5.1 Routes of Exposure
Paragraph:	2
Sentence:	last
Statement:	*Dermal exposure to MTBE present in bath water is expected to be minimal in comparison to inhalation and ingestion of MTBE at the exposure concentrations for the average individual, was therefor not considered in this analysis (Brown 1997).*
Comment:	The authors should explain why dermal exposure was not considered since paragraph 1 on page “x” of the executive summary says that animal studies indicate that dermal uptake may be an important route of entry.

Section # and Title:	2. Exposure Assessment
Page #:	12
Sub-section title:	2.5.3 Exposure Concentration Data
Paragraph:	5
Sentence:	2
Statement:	*MTBE was detected in approximately 1.3% of the sampled sources (45 out of 2998 samples).*
Comment:	45/2998 = 1.5%, not the 1.3% listed here or the 1.6% listed in Section 2.2.4 of this volume. Are the number of detections and samples correct, as listed in the report?

Section # and Title:	2. Exposure Assessment
Page #:	12
Sub-section title:	2.5.3 Exposure Concentration Data
Paragraph:	5
Sentence:	last sentence in paragraph
Statement:	*The resulting statewide average of MTBE concentration in drinking water was estimated to be 2.5 ug/L.*
Comment:	The use of substitution methods, such as used in the report, to compute summary statistics when a large percentage of the data are reported as less than the reporting limit is not technically defensible. The choice of substituting 2.5 ug/L (one-half the reporting limit) for those values reported as "less than the reporting limit" is essentially arbitrary without some knowledge of instrument readings below the reporting limit. Gilliom and Helsel (1986) have shown that these types of substitution methods perform poorly for estimating summary statistics in comparison to other procedures such as robust probability plot which is described in Helsel and Hirsch, (1992).

Reference: Gilliom, R.J., and D.R. Helsel, 1986, Estimation of distributional parameters for censored trace level water quality data, 1. Estimation techniques: Water Resources Research 22, pp. 135-146.

Helsel, D.R. and Hirsch, R.M., 1992, Studies in Environmental Science 49: Statistical methods in Water Resources, Elsevier Science Publishers, Netherlands, 522 p.

Section # and Title:	2. Exposure Assessment
Page #:	14
Sub-section title:	2.5.5 Average Exposure to Adults
Paragraph:	2
Sentence:	first
Statement:	*Estimated daily chronic doses of MTBE in adults respectively ranged from 0.0006-0.0044 mg/kg-m^3 (Los Angeles/Burbank), 0.0003-0.0052 mg/kg-m^3 (San Francisco Bay Area), 0.0003-0.0028 mg/kg-m^3 Central Valley), and 0.0004-0.0036 mg/kg-m^3 (South Coast).*
Comment:	The range for the adult daily dose in Los Angeles/Burbank is listed as 0.00045-0.0043 mg/kg-day on Table 1. This range of values does not correspond with the text. Suggest changing all units in sentence 1 from mg/kg-m^3 to mg/kg-day.

Section # and Title:	2. Exposure Assessment
Page #:	14
Sub-section title:	2.5.5 Average Exposure to Adults
Paragraph:	2
Sentence:	3
Statement:	*The predictions of this assessment (~ 0.0015 mg/kg-m^3) are in general agreement with results reported by Brown et al (0.00105 mg/kg-m^3) for the daily dose of MTBE via inhalation for the general public.*
Comment:	Please explain how the number 0.0015 mg/kg-m^3 was derived and refer to an appropriate table. The units in this sentence should be changed to mg/kg-day.

Section # and Title:	2. Exposure Assessment
Page #:	15
Sub-section title:	2.5.6 Average Exposure to Children
Paragraph:	3
Sentence:	1
Statement:	*Estimates of breathing (OEHHA 1996) and drinking (OEHHA 1996) rates and body weights for children aged 1 to 10 years were obtained from the Technical Support Document entitled "Exposure Assessment and Stochastic Analysis" produced by (OEHHA 1996) (Columns 5-8).*
Comment:	Suggest changing "(Columns 5-8)" to "(Columns 5-8 and 10-11).

Section # and Title:	2. Exposure Assessment
Page #:	15
Sub-section title:	2.5.6 Average Exposure to Children
Paragraph:	3
Sentence:	1
Statement:	*Estimated daily chronic doses of MTBE in children respectively ranged from 0.0038-0.0047 mg/kg-m^3 (Los Angeles/Burbank), 0.0045-0.0057 mg/kg-m^3 (San Francisco Bay Area), 0.0024-0.0030 mg/kg-m^3 (Central Valley), and 0.0030-0.0038 mg/kg-m^3 (South Coast).*
Comment:	All units should be changed to mg/kg-day. Also, correct the range of values for Los Angeles/Burbank so that the text values and values in Table 5 are in agreement.

Section # and Title:	2. Exposure Assessment
Page #:	17
Sub-section title:	2.5.9 Exposure to MTBE via Air and Water Among Los Angeles
Paragraph:	4
Sentence:	last
Statement:	*The estimated daily exposure to MTBE among Los Angeles/Burbank residents living in proximity to service stations was 0.0022-0.0051 mg/kg-day, a result that is roughly 1.2-4 fold greater in magnitude than the estimated daily exposure of MTBE among average adult individuals living in the Los Angeles/Burbank area (0.0006-0.0044 mg/kg-day).*
Comment:	Correct the range of exposures in LA/Burbank area so that text values and values in Table 1 are in agreement.

Section # and Title:	2. Exposure Assessment
Page #:	18
Sub-section title:	2.5.10 Exposure to Air and Water in CA Among
Paragraph:	1
Sentence:	first
Statement:	*Table 12 provides an estimate of the daily exposure to MTBE among individuals who use tap water from surface and groundwater sources that contain MTBE at the odor threshold (35 ug/L).*
Comment:	Suggest that the authors explain how the odor threshold of 35 ug/L was derived or refer the reader to the section that explains this. Section 3.1 of Volume I indicates that the odor threshold ranges from 2-190 ug/L.

Section # and Title:	2. Exposure Assessment
Page #:	18
Sub-section title:	2.5.10 Exposure to Air and Water in CA Among
Paragraph:	2
Sentence:	first
Statement:	*The estimated daily exposure to MTBE among residents who use tap water containing 16.67 ug/L of MTBE was estimated to be 0.0015-0.0055 mg/kg-day, a result that is slightly higher in magnitude than the estimated daily exposure of MTBE among adult individuals living in the Los Angeles/Burbank area (0.0006-0.0048 mg/kg-day).*
Comment:	Should 16.67 ug/L be 35 ug/L? If not, please explain what 16.67 ug/L represents. Data in both of the ranges provided in this sentence do not match the ranges provided in the appropriate tables. Correct the ranges so that the values in the text and the tables are in agreement.

Section # and Title:	2. Exposure Assessment
Page #:	18
Sub-section title:	2.5.11 Summary of Exposure Findings
Paragraph:	3
Sentence:	3
Statement:	*Minimum and maximum predicted doses for adults in four California regions are summarized in Table 13.*
Comment:	Correct the data for Los Angeles/Burbank so that Table 1 and 13 are in agreement.

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.3 MTBE Byproducts: 2.3.1 Tert-Butyl Formate
Paragraph:	1
Sentence:	1

Statement: *Tert butyl formate (TBF) is formed as a major product in exhaust emissions from cars using gasoline containing MTBE*.

Comment: TBF is an important combustion by-product of MTBE at ambient temperatures. TBF is not a by-product of MTBE combustion at elevated temperatures. Studies have not reported TBF in automotive exhaust. TBF is a by-product of MTBE degradation in the atmosphere.

The authors should consider rewording the above statement as follows: TBF is formed in the atmosphere from MTBE evaporative and unburned fuel emissions, from vehicles using gasoline containing MTBE.

Reference: Japar, S.M., Wallington, T.J., Rudy, S.J., and Chang, T.Y., 1991, Ozone-forming potential of a series of oxygenated compounds: Environmental Science and Technology, vol. 25, no. 1, pp. 415-420.

Tuazon, E.C., Carter, W.P.L., Aschmann, S.M., and Atkinson, Roger, 1991, Products of the gas-phase reaction of methyl tert-butyl ether with the OH radical in the presence of NOx: International Journal of Chemical Kinetics, vol. 23, pp. 1003-1015.

Smith, D.F., Kleindienst, T.E., Hudgens, E.E., McIver, C.D., and Bufalini, J.J., 1991, The photooxidation of methyl tertiary butyl ether: International Journal of Chemical Kinetics, vol. 23, pp. 907-924.

(Comment continued on next page)

Comment (cont.)

Japar, S.M., Wallington, T.J., Richert, J.F.O., and Ball, J.C., 1990, The atmospheric chemistry of oxygenated fuel additives: t-butyl alcohol, dimethyl ether, and methyl t-butyl ether: International Journal of Chemical Kinetics, vol. 22, pp. 1257-1269.

Smith, D.F., McIver, C.D., Kleindienst, T.E., 1995, Inetics and mechanism of the atmospheric oxidation of tertiary amyl methyl ether: International Journal of Chemical Kinetics, vol. 27, pp. 453-472.

Harley, R.A., Hannigan, M.P., and Cass, G.R., 1992, Respeciation of organic gas emissions and the detection of excess unburned gasoline in the atmosphere: Environmental Science and Technology, vol. 26, no. 12, pp. 2395-2408.

Cox, R.A., and Goldstone, Annmarie, 1981, Atmospheric reactivity of oxygenated fuel additives: in Physio-Chemical Behavior of Atmospheric Pollutants, Proceedings of the Second European Symposium held in Varese, Italy, 29-September – 1-October 1981, pp. 112-119.

Dunker, A.M., Morris, R.E., Pollack, A.K., Schleyer, C.H., and Yarwood, Greg, 1996, Photochemical modeling of the impact of fuels and vehicles on urban ozone using auto/oil program data: Environmental Science and Technology, vol. 30, no. 3, pp. 787-801.

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.3 MTBE Byproducts: 2.3.2 Formaldehyde
Paragraph:	1
Sentence:	3
Statement:	*… (Gorse et al., 1991)*
Comment:	The reference for Gorse et al. (1991) is missing from the list of references.

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5 Estimation of exposure to MTBE via air and water in California
Paragraph:	1
Sentence:	3
Statement:	*… (Burmaster, 1996)*
Comment:	The reference for Burmaster (1996) is missing from the list of references or is the author(s) referring to Burmaster and Hall (1996)?

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5.2 Time activity data
Paragraph:	1
Sentence:	3
Statement:	*… (Burmaster, 1996)*
Comment:	The reference for Burmaster (1996) is missing from the list of references or is the author(s) referring to Burmaster and Hall (1996)?

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5.3 Exposure concentration data
Paragraph:	1
Sentence:	3
Statement:	*… (BAAQMD, 1998)* *… (CARB, 1991a)*
Comment:	The reference for BAAQMD (1998) is missing from the list of references. The reference for CARB, 1991a is missing from the list of references. There are two reference for CARB (1991) in the references, which one goes here?

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5.3 Exposure concentration data
Paragraph:	7
Sentence:	equation
Statement:	*Ca = C * f * WHF / (HV*ER*MC)*
Comment:	Should this equation be: Ca = Cw * f * WHF/ (HV*ER*MC)? C_w (not C) is defined in the following paragraph.

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5.5 Average Exposure to Adults
Paragraph:	2
Sentence:	3
Statement:	*… results reported by Brown et al …*
Comment:	The reference for Brown et al. is missing from the list of references or should this be Brown (1997)?

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5.5 Average Exposure to Children
Paragraph:	1, 3
Sentence:	
Statement:	*CARB, 1991b* *OEHHA, 1996*
Comment:	There are multiple entries for CARB (1991) and OEHHA (1996) in the list of references. Which reference do these citations refer to?

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5.7 Road tank driver exposure to MTBE via air/water in the LA/Burbank area
Paragraph:	1
Sentence:	
Statement:	*… Hinton et al (1993) and Brown et al (1997).*
Comment:	Should these references be Hinton (1993) and Brown (1997)? If not, the Hinton et al. and Brown et al. references need to be added to the list of references.

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.5.8 Service station worker exposure to MTBE via air/water in LA/Burbank area
Paragraph:	1
Sentence:	
Statement:	*… Hinton et al (1993)*
Comment:	Should this reference be Hinton (1993)? If not, the article by Hinton et al. needs to be added to the list of references.

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.6 Conclusions
Paragraph:	1
Sentence:	1
Statement:	*Predicted daily does of MTBE among road tank drivers and service station workers were estimated to be ~ 0.1 mg/kg-day, values that are approximately two fold higher than exposure to MTBE in the general population.*
Comment:	Change "two fold higher" to "two orders of magnitude higher".

Section # and Title:	2. Exposure Assessment
Page #:	19
Sub-section title:	2.6 Conclusions
Paragraph:	4
Sentence:	3
Statement:	*This result is consistent with previous studies which examined population exposure to MTBE (Ghirelli et al 1997).* ***(some of the data that was included in this web site has since changed. It does not contain info on the relative source contribution of MTBE in air and water to the total exposure to MTBE)***
Comment:	What web site is referred to?

Section # and Title:	References
Page #:	185
Sub-section title:	
Paragraph:	
Sentence:	
Statement:	*Burmaster, David E., Hull, Delores A.,*
Comment:	The correct reference should be Burmaster, David E., Hull, Delores A., 1996,

Section # and Title: References

Page #: 185

Sub-section title:

Paragraph:

Sentence:

Statement:

Comment: Suggest using a consistent format for all references.

Section # and Title:	13. References
Page #:	181 to 210
Sub-section title:	
Paragraph:	All
Sentence:	various
Statement:	
Comment:	Pg 196: There are two citations for Leuschner et al. (1991). Distinguish these using (a) and (b). Pg 204: Savolainen (1985) is referred to as 1995 on page ix. Which is correct?

Section # and Title:	Tables 1-12 near end of Volume II
Page #:	No page numbers
Sub-section title:	2.5.3 Exposure Concentration Data
Paragraph:	
Sentence:	
Statement:	*The row in tables 1-12 that addresses "Chronic Daily Doses" based on "Ingestion of Water."*
Comment:	These results are presented inconsistently in the various tables. Based on the same input values (which should give the same results), the "Dose of MTBE total (max and min) for non-children are variously reported as "0" (table 1), 7.14286E-5 (tables 2, 3, 9), 0.0001 (table 4), and 7.14E-5 (table 10), 7.143E-5 (table 11). While these difference may be attributable to differences in rounding, the inconsistent presentation should be corrected. In the tables for children, the rows reporting exposure due to ingestion of water are not adequately labeled. Also, what is the basis of the assumption that % absorption is only 50% for children and 100% for the general population?

Section # and Title:	Table 15 near end of Volume II
Page #:	No page numbers
Sub-section title:	
Paragraph:	
Sentence:	
Statement:	*Included in the table column labeled "Threshold Value (ppb) are descriptions such are "terpene-like" etc*.
Comment:	The “terpene-like” appears to be an error. These descriptive terms do not belong in this table.

Sub-section title:	Characterization of Ecological Risk
Page #:	4
Paragraph:	1
Sentence:	
Statement:	*...we selected two water bodies as representative of systems in California, Donner Lake and Lake Perris"*
Comment:	As commented on in the report Summary, the characterization of these two lakes as "representative" may be misleading. Better just to present them as examples. The discussion in Volume I, page 36 (6.1.2.3) gives good perspective on how the selected lakes should be characterized: "These lakes [including Calereo] were chosen as they represent a broad range of geographical, climatological and limnological conditions."

Sub-section:	1.1 Sources of MTBE in Groundwater
Page #:	6
Title:	
Paragraph:	5
Sentence:	1
Statement:	*MTBE sources of groundwater contamination include leaking underground fuel tanks (LUFT's), above ground storage tanks, farm tanks, leaking petroleum fuel pipelines, underground storage tanks containing fuels other than gasoline, surface spills due to automobile or tanker truck accidents, surface spills due to abandoned or parked vehicles, MTBE contaminated surface water, and precipitation.*
Comment:	Atmospheric sources of MTBE include diffusion from the atmosphere to water in addition to precipitation.

Sub-section:	1.1 Sources of MTBE in Groundwater
Page #:	7
Title:	
Paragraph:	2
Sentence:	1 & 2
Statement:	*Only a small portion of the MTBE consumed, 0.33 percent (OEHHA, 1989), is released to the atmosphere. Depending on local conditions, a fraction of the 0.33 percent is available to leach into groundwater.*
Comment:	Clarify...does 0.33 percent released to atmosphere mean the rest is combusted? Or are there other loss mechanisms?

Sub-section:	1.1 Sources of MTBE in Groundwater
Page #:	7
Title:	
Paragraph:	2
Sentence:	4
Statement:	*In the U.S. Geological Survey's National Water Quality Assessment (NAWQA), 97 percent of the samples from shallow urban wells detected MTBE at concentrations of less than 20 ugL-1 (Pankow et al., 1997).*
Comment:	Reference to shallow ground water detections in NAWQA should be Squillace and others (1995), not Pankow (1997).

Sub-section: 1.2 General Characteristics of MTBE Transport in Groundwater

Page #: 7

Title:

Paragraph: 3

Sentence:

Statement: Transport of MTBE in groundwater is controlled by the rate of groundwater movement, concentration and longevity of the source, and dispersion (i.e., the process whereby concentration of a dissolved chemical is reduced by dilution and the contaminant front spreads faster than the average rate of groundwater movement). Unlike petroleum hydrocarbons such as benzene, transport of MTE does not appear to be limited appreciably by sorption (i.e., temporary retention of the contaminant on soil and sediment particles) or biodegradation by native microorganisms. Consequently, MTBE will potentially move with the groundwater in a manner similar to subsurface transport of, for example, chlorinated organic compounds such as TCE (trichloroethene). Extensive TCE groundwater plumes are often observed – on the order of 1,000's of feet in length. Owing to MTBE's high solubility and rather large volumetric fraction in reformulated gasoline (~11 percent), concentrations in groundwater can be very high – on the order of 6,000,000 ug/L (Zogorski et al., 1996; Happel et al., 1998).

Comment: The authors should reconsider the analogy of MTBE to TCE plumes because of differences in partitioning and source type. For example, the aqueous solubility and the organic carbon/water partition coefficient, K_{oc}, of MTBE and TCE are quite different. These differences in properties (as well as other factors) will cause differences in the migration behavior of MTBE versus TCE.

The authors should consider describing these differences in their comparison of MTBE's behavior to TCE. Alternatively, maybe a different compound, such as tritium or an inorganic salt, would provide a better comparison.

Sub-section: 1.2 General Characteristics of MTBE Transport in Groundwater

Page #: 7

Title:

Paragraph: 3

Sentence: 2

Statement: Unlike petroleum hydrocarbons such as benzene, transport of MTBE does not appear to be limited appreciably by sorption (i.e., temporary retention of the contaminant on soil and sediment particles) or biodegradation by native microorganisms.

Comment: As noted in another comment previously, in many cases, the BTEX compounds are not retarded by sorption much more than is MTBE.

References: Borden R.C., and others, 1997, Intrinsic biodegradation of MTBE and BTEX in a gasoline contaminated aquifer: Water Resources Research, Vol. 33, no. 5, pp. 1105-1115.

Schirmer, M., and Barker, J.F., 1998, A study of long-term MTBE attenuation in the Borden aquifer, Ontario, Canada: Ground Water Monitoring and Remediation, Spring 1998, pp. 113 – 122.

Sub-section:	1.2 General Characteristics of MTBE Transport in Groundwater
Page #:	7
Title:	
Paragraph:	3
Sentence:	Last
Statement:	*… concentrations in groundwater can be very high – on the order of 6,000,000 mg/L (Zogorski et al., 1996; Happel et al., 1998).*
Comment:	Zogorski et al., (1996) report the solubility of MTBE in water at room temperature (from 10% MTBE RFG gasoline) as 5,000,000 µg/L (not 6,000,000 µg/L). Also, this is the maximum theoretical level and actual levels in ground water are expected to be less because of dilution, dispersion, and depletion of MTBE from the source.

Sub-section: 2.0 Regional Data Sources

Page #:

Title:

Paragraph:

Sentence:

Statement: …

Comment: The report does not summarize ambient ground water data from USGS collected for NAWQA studies of the San Joaquin and Sacramento Basins. This is a major source of information with an emphasis on ambient water quality.

Sub-section: 2.0 Regional Data Sources

Page #: 10

Title:

Paragraph:

Sentence:

Statement:

Comment: The authors should consider mentioning California Air Board and USGS monitoring programs in Section 2.

Sub-section:	3.1 MTBE in Gasoline
Page #:	11
Title:	
Paragraph:	4
Sentence:	3
Statement:	By 1995 it was ranked twelfth, and by 1997 it was ranked second (OEHHA, 1998).
Comment:	What compound was #1?

Sub-section:	3.2.4 Concentrations of MTBE in Groundwater at LUFT Sites
Page #:	28
Title:	
Paragraph:	Fig. 6
Sentence:	
Statement:	
Comment:	The units for the “x” axis on figure 6 should be relabeled to be ug/L.

Sub-section:	3.2.4 Concentrations of MTBE in Groundwater at LUFT Sites
Page #:	28
Title:	
Paragraph:	1
Sentence:	Last
Statement:	*The high concentrations found at many sites are not surprising, given the high solubility of MTBE in water (50,000 ug/L Zogorski et al., 1996), the low sorption potential of MTBE, and its recalcitrance with respect to biodegradation.*
Comment:	Zogorski et al., (1996) report the solubility value of 50,000 mg/L for the dissolution of neat MTBE into water. Since this section concerns gasoline release sites, a solubility value of 5,000 mg/L is more applicable in that this latter value represents the theoretical solubility of MTBE in water with 10% MTBE gasoline as the source. Zogorski et al. (1996) provide equations to estimate the solubility of MTBE in water from gasoline.

Sub-section:	4.0 Other Sources of MTBE Groundwater Contamination
Page #:	32
Title:	
Paragraph:	2
Sentence:	all
Statement:	*Atmospheric deposition has been implicated as the source of low levels of MTBE identified, as part of the United States Geological Survey (USGS) studies, …*
Comment:	The reference to atmospheric deposition studies of the USGS should include a summary of the following recent report: Baehr, A.L., Stackelberg, P.E., and Baker, R.J., 1999, Evaluation of the Atmosphere as a Source of Volatile Organic Compounds in Shallow Ground Water, Water Resources Research, vol. 35, no. 1, pp. 127-136.

Sub-section: 4.0 Relevance of California Air Quality Data

Page #: 33

Title:

Paragraph:

Sentence:

Statement: …

Comment: The air quality data summarized on page 33 is relevant with respect to possible detection of MTBE in ground water in urban areas. For example using the dimensionless Henry's Law value of .01 at 15 degrees implies that 1 ug/L in water corresponds to about 3 ppb in air. Therefore, the maximum and average MTBE air concentrations reported on Table 7 would be relevant and be a possible source for detection of low levels of MTBE in shallow ground water.

Sub-section: 1.5.2 Detects in Public Water Supply Wells

Page #: 35

Title:

Paragraph: 3 & 4

Sentence: All

Statement: *The DHS Water Quality Information (WQI) Database (September 1998) listed 32 public water supply (PWS) wells which have reported detection in excess of 0.5 ug/L of MTBE in addition, information received from the 14 LPA's responding to our inquiries indicated that three public water system wells in San Luis Obsipo have been impacted by MTBE. A total of 35 PWS wells have been impacted by MTBE to date, based on available information (Table 8; Fig. 7). If it is assumed that cost of the impacts that have been identified resulted from contamination entering the subsurface environment prior to 1996, then it can be expected that the impacts will continued to increase, regardless of whether MTBE's use is discontinued, because the use of MTBE has increased since 1996.*

PWS wells with detections of contaminants undergo an assessment to determine the source of the contamination. In many cases this is complex because it involves issues of property damage with litigious implications. Agencies require a high level of certainty before identifying a responsible party. Additionally, some DHS districts are severely understaffed and not able to respond at the speed that new PWS wells are impacted by MTE. Full site histories and characterizations of possible sources of the MTBE contaminants detected in these wells were not obtained for all wells. Assessments in other states (Hitzig et al, 1998) indicate that ……

Comment: The terms detected and impacted are not interchangeable terms and should be used cautiously. Impacted has a regulatory context, that is, a well contaminated above a maximum contaminant level (i.e. drinking water standard) or guideline.

Which agency or entity conducts the assessment to determine the source of PWS contamination?

Sub-section: 1.5.2 Detects in Public Water Supply Wells

Page #: 35

Title:

Paragraph: 1

Sentence: 1

Statement: *Public Water Supply (PWS) wells with detections of contaminants undergo an assessment to determine the source of contamination.*

Comment: A review of the California Department of Health Services (DHS) web page that lists MTBE monitoring data for public drinking water sources and systems indicates that most of the high level detection of MTBE (> 5 ug/L) are for wells in 3 cities (Santa Monica, South Tahoe, and Marysville). The source of MTBE for these wells are known UST releases. Nearly all of the remaining detections of MTBE in drinking water supply wells (n=21) were low level detections with many concentrations in the 1-2 ug/L range, or less. The source of these low level detections is not specified in the DHS data base or in the CA assessment. The possible sources of low level detections of MTBE in ground water include both point and non-point sources (Squillace and others, 1996). The source of the low detections should be investigated so that targeted regulatory approaches can be implemented in an effective manner. The State of Maine's study of MTBE in water supply sources found that the proximity of gasoline storage tanks to sampled wells did not explain MTBE detections. Sources of MTBE other than storage tank releases may explain some of the low level detections in CA's drinking water supply wells.

Sub-section:	1.5.2 Detects in Public Water Supply Wells
Page #:	35
Title:	
Paragraph:	4
Sentence:	3
Statement:	*A total of 35 PWS wells have been impacted by MTBE to date, based on available information (Table 8; Fig. 7).*
Comment:	The number of wells affected is clearly stated, however, no characterization is given in terms of the concentrations of MTBE found versus California's 5 ug/L and 14 ug/L benchmarks. Experience elsewhere suggests that most of the wells that contain MTBE, have low levels of MTBE. More importantly, what levels were detected in the drinking water itself of the systems reflected by the 35 wells? Another area of potential concern about California's PWS monitoring data set and associated analysis is that varied reporting levels are used by the laboratories that did the testing and the assessment by the authors presumably did not consider this. The frequency of detection of MTBE and other VOCs increases as the reporting level is decreased. Characterizing the frequency of occurrence of MTBE in PWS wells must use a common assessment level (0.1 μg/L, 1 μg/L, 5 μg/L, etc.). Because of the above, the estimated PWS wells impacted may not be correct. The authors should consider incorporating more discussion about laboratory reporting limits, and how this variability was addressed in their evaluation.

Sub-section:	5.0 Contamination of Drinking Water Wells by MTBE
Page #:	40
Title:	
Paragraph:	
Sentence:	
Statement:	…
Comment:	In providing statistical summaries of the public supply wells (eg. 5% of wells had MTBE detected at .5 ug/l and above) it would be meaningful to provide the analogous statistic for select VOCs to provide context for the MTBE data. Without such a comparison one can not evaluate the uniqueness of the MTBE problem. The list of VOCs should include BTEX compounds in addition to select chlorinated compounds which have been frequently detected in ground water (eg. DBCP, chloroform, PCE, TCA, TCE).

Sub-section:	5.3 Estimated Statewide Impacts on Public Water Supply Wells
Page #:	40
Title:	
Paragraph:	
Sentence:	
Statement:	General comment on contamination at detectable levels of PWS due to other sources.
Comment:	In general, all sources of MTBE originate at or very near land surface. Given that a PWS well in a surficial aquifer can draw in very young water from within its contributing area, the relevance of non LUFT sources for low level detection should be considered. LUFT sources or other sources involving spilled gasoline is required to explain higher concentrations.

Sub-section: 5.4 Estimated Statewide Impacts on Private Wells

Page #: 42

Title:

Paragraph:

Sentence:

Statement:

Comment: The data on MTBE concentrations in ground water collected by the USGS NAWQA program studies in the San Joaquin-Tulare Basins and the Sacramento Basin should be cited by the author. The San Joaquin-Tulare Basins study sampled 88 private domestic water supply wells in alluvial fan deposits in agricultural areas of the eastern San Joaquin Valley from 1993 through 1995. MTBE was not detected in any of the wells (MRL = 0.2 ug/L). Similarly, 30 domestic water supply wells were sampled in the alluvial fan deposits in rural areas of the eastern Sacramento Valley in 1996, and only one well had a low-level detection. An additional 19 monitoring wells were installed and sampled in 1998 in the Sacramento urban area. These wells were not located near any known point sources (LUST etc.) and only one well had a detectable MTBE concentration (1.47 ug/L). The studies in the Sacramento Basin had a slightly lower analytical detection level for MTBE (MRL≈ 0.05 ug/L).

Sub-section: 5.4 Estimated Statewide Impacts on Private Wells

Page #: 42-43

Title:

Paragraph: Entire section

Sentence:

Statement:

Comment: The State of California has not collected statewide information of MTBE levels in drinking water provided by homeowner wells. As of 1998, only the State of Maine has completed such statewide monitoring and it is important to note that the occurrence of MTBE in domestic wells in Maine was not related to the nearness of gasoline storage tanks (State of Maine, 1998). Estimating the impact of MTBE RFG use in California on private wells from public supply well data is questionable. For example, the contributing area of public supply wells would be much larger than private wells due to the difference in pumping rates and other factors. At a minimum the authors should acknowledge the limitations of their approach and offer suggestions on how to assemble a definitive MTBE data set for private wells.

Reference: State of Maine, 1998, The presence of MTBE and other gasoline compounds in Maine's drinking water: A preliminary report October 13, 1998; prepared by Maine Department of Human Services; Bureau of Health, Maine Department of Environmental Protection, Bureau of Waste Management and Remediation; Department of Conservation, Maine Geological Survey, 15 p.+ attachments.

Sub-section:	5.4 Estimated Statewide Impacts on Private Wells
Page #:	43
Title:	
Paragraph:	3
Sentence:	*"Direct comparisons between our results and those of Maine are difficult due to differences in detection limits."*
Statement:	Comparison of CA and Maine frequencies of MTBE detection.
Comment:	The authors should consider mentioning that there are huge climate and hydrogeologic differences between Maine - the most obvious that Maine has high precipitation and shallow depths to ground water, while California has little precipitation and great depth to ground water. In general, these factors make ground water in Maine much more susceptible than ground water in California. Reference to the State of Maine's MTBE study is appropriate to provide general context for another state's assessment of the occurrence of MTBE in drinking-water wells. Because of the differences in laboratory reporting levels (as noted by the authors) between the California community well data set and the State of Maine's study, and the differences in climatic and hydrogeologic conditions noted above, the findings in the State of Maine for domestic and community water supply wells are not directly applicable to California. The authors might consider stating this more explicitly in their discussion of results from the State of Maine's study.

Sub-section: 6.1.1 Precipitation Sampling

Page #: 45

Title:

Paragraph: General Comment

Sentence:

Statement:

Comment: Additional evidence that little or no MTBE in precipitation contributes to Lake Tahoe MTBE concentrations can be cited. USGS sampling of lakes in the Tahoe Basin (3 lakes) that have little or no motorized boat traffic showed no MTBE (Boughton and Lico, 1998). If atmospheric input was significant, these lakes would have measurable concentrations of MTBE.

Reference: Boughton, C.J., and M.S. Lico, 1998, Volatile organic compounds in Lake Tahoe, July-September, 1997: USGS Fact Sheet FS-055-98, 4 p.

Sub-section:	6.1.2 Shallow Groundwater Sampling
Page #:	46
Title:	
Paragraph:	2
Sentence:	last
Statement:	*These Nevada sites are part of the USGS groundwater monitoring network for the Lake Tahoe Basin (Boughton et al., 1997) and were sampled in cooperation with Tim Rowe and Kip Allander of the Carson City office of the USGS.*
Comment:	The appropriate citation for cooperation is with the USGS's Carson City office. Recognition of individual USGS staff in the narrative text is not necessary.

Sub-section:	6.1.2 Shallow Groundwater Sampling
Page #:	46
Title:	
Paragraph:	3
Sentence:	3
Statement:	*Groundwater samples were dispensed into 45 ml amber VOA vials, which were filled to the rim such that no headspace was present in the capped vial.*
Comment:	VOA vials are usually 40 mL, not 45 mL. The authors should check to make sure the volume of the VOA vials as stated is correct.

Sub-section: 6.1.3 Summary of Non-LUFT Site Data

Page #: 48

Title:

Paragraph: 1

Sentence:

Statement: *Snow samples collected June 5, 1998 at 8,600 ft elevation downwind from an urbanized area of Lake Tahoe contained no detectable MTBE (<0.1 ug-L^{-1}). Two shallow wells located in Pope Marsh at approximately 50 and 110 ft from the Lake Tahoe shoreline tested positive for MTBE in replicate samples, at levels between 0.1 and 0.2 ug-L^{-1}. The source of MTBE in the two Pope marsh wells was most likely water from Lake Tahoe because: (1) nearby water samples from Lake Tahoe contained MTBE at 1-2 ug-L^{-1}, (2) groundwater flow is from Lake Tahoe into the marsh during summer months (Green, 1998), and (3) eight other shallow wells in this marsh, all located further away from Lake Tahoe, tested negative for MTBE (<0.1 ug-l^{-1}).*

Comment: USGS water chemistry and stable isotopes of water do not support the authors' conclusions that lake water is the source of MTBE in the shallow ground water in the marsh.

	Delta D	Delta O-18
Well #20 (8-13-95)	-92.4	-12.2
Lake Tahoe	-58	- 5.5 (approx)
Precipitation in Tahoe Basin	-99	-14.3 (USGS unpublilshed data)
Shallow gw in Tahoe Basin	-106	-14.5 (Thodal, 1997)

(Comment continued on next page)

Comment (cont.): Gradients appear to be toward the lake at all times of the year according to the data USGS has collected. Another piece of evidence to support no lake water in the shallow aquifer in Pope Marsh is the specific conductance of the well water. This sample had a specific conductance of 150 uS/cm and lake water is usually <90 uS/cm. It seems likely that the source of the water in the well is from upgradient in the marsh and has been slightly evaporated to produce the higher specific conductance and slightly heavier isotope values.

Reference: Thodal, C.E., 1997, Hydrogeology of Lake Tahoe Basin, California and Nevada, Results of a ground-water quality monitoring network, water years 1990-92: U.S. Geological Survey Water-Resources Investigations Report 97-4072, 53 p.

Sub-section:	6.2.3 Focus on Southern Portion of the Lake Tahoe Basin
Page #:	51
Title:	
Paragraph:	4
Sentence:	3
Statement:	*Another LUFT site has an MTBE plume of length >640 ft extending to within 500 ft of STPUD wells Backrock #1 and #2, and to within….*
Comment:	Add "l" to "Backrock" to read Blackrock.

Sub-section:	6.2.3 Focus on Southern Portion of the Lake Tahoe Basin
Page #:	52
Title:	
Paragraph:	1
Sentence:	2nd to last sentence
Statement:	*The second LUFT site is located 1,500 ft from Tata well #4 (pumping capacity 70 gpm), at a 45 degree angle upgradient to the regional surface water gradient (Pinnacle Environmental Solutions, 1998).*
Comment:	Do you mean “ground-water gradient”, or “surface-water gradient” as written?

Sub-section:	6.2.4 Summary of LUFT Site Data in Tahoe Basin
Page #:	53
Title:	
Paragraph:	2
Sentence:	last
Statement:	*These analyses pertain mainly to alluvial aquifers consisting of unconsolidated to semi-consolidated materials (sand, gravel, silt and clay).*
Comment:	There appears to be inconsistent use of terminology regarding the makeup of the shallow aquifer lithology. Is "unconsolidated glaciofluvial" the same as "alluvial aquifers of unconsolidated to semiconsolidated materials"?

Sub-section: 7.0 Future Impacts of LUFT Plumes

Page #: 53

Title:

Paragraph: 3

Sentence: 4

Statement: *Further, we have found no definitive, field studies demonstrating degradation of MTBE in groundwater.*

Comment: Two field studies have documented the natural attenuation of MTBE in ground water via biodegradation.

Reference: Borden, R.C., and others, 1997, Intrinsic biodegradation of MTBE and BTEX in a gasoline contaminated aquifer: Water Resource Research, vol. 33, no. 5, pp. 1105 – 1115.

Schirmer, M., and Barker, J.F., 1998, A study of long-term MTBE attenuation in the Borden aquifer, Ontario, Canada: Ground Water Monitoring and Remediation, Spring 1998, pp. 113 – 122.

Sub-section: 7.1 Generalized Analysis of MTBE Plume Growth

Page #: 54

Title:

Paragraph:

Sentence:

Statement: Authors statement on relation of MTBE plume growth to predicted increase in detection frequency in public supply wells.

Comment: Models to predict future impacts of MTBE releases to water-supply wells should be used with caution because there are large uncertainties in the assumed processes and input conditions. The modeling approach used was conservative and may over predict the actual risk of LUST releases to water-supply wells because: (1) it assumes that the concentration of MTBE in the area of a gasoline release (i.e. the source strength) is maintained at a constant level over the period of prediction; (2) two processes that would reduce the concentrations of MTBE, biodegradation and volatilization (Borden and others, 1997; Schirmer and Barker, 1998; and Baehr and others, 1997), were not incorporated in model simulations; and (3) the analysis assumes that predicted plumes will travel across the contributing areas of water-supply wells and be drawn to the wells. Additional modeling would suggest the potential importance of the abovenoted conditions/processes. The reliability of risk projections could be improved by long-term monitoring of MTBE in water-supply wells and ambient ground water.

Reference: Borden, R.C., and others, 1997, Intrinsic biodegradation of MTBE and BTEX in a gasoline contaminated aquifer: Water Resource Research, vol. 33, no. 5, pp. 1105 – 1115.

(Comment continued on next page)

Comment (cont.):

Schirmer, M., and Barker, J.F., 1998, A study of long-term MTBE attenuation in the Borden aquifer, Ontario, Canada: Ground Water Monitoring and Remediation, Spring 1998, pp. 113 – 122.

Baehr, A.L., and others, 1997, Transport of MTBE across the water table to the unsaturated zone at a gasoline-spill site in Beaufort, SC: preprint of papers, 213th ACS National Meeting, vol., 37, no. 1, pp. 417 – 418.

Sub-section: 7.1 Generalized Analysis of MTBE Plume Growth

Page #: 54

Title:

Paragraph: 2

Sentence:

Statement: …

Comment: If I understand the authors analysis correctly, they have assumed that the increase in MTBE plume length of 3-4 by the year 2010 will result in a corresponding increase in the probability of impact on public water supplies. Since the implications of increased detection are significant, I think the authors should discuss the basis for that assumption (and possible problems with the assumption) in greater detail. This might include how do uncertainties in the values of 0.3 and 1.2% affect the extrapolated values?

How does the increase in concentration of MTBE in gasoline since 1996 likely to affect the probability of detection independent of longer plume lengths?

The relationship between plume length and probability of detection depends upon a number of factors including width of capture zone, vertical spreading, and horizontal spreading. These factors in turn depend upon the aquifer and pumping conditions, recharge, regional flow direction. What are the assumptions necessary in order to extrapolate the probability? As an example, the longer the plume, the more likely it will be able to move downward and reach the well screen. This could cause the probability of impact to increase more than simply in proportion to plume length.

Sub-section: 7.2 Vertical Migration

Page #: 59

Title:

Paragraph:

Sentence:

Statement: *Figure 12.* Re: vertical migration.

Comment: The most relevant vertical migration would be that induced by a flowing well. It appears that in the simulation presented that the plume is within the contributing area of the well. What would be the relevance of vertical migration if this was not the case? This other important case should be discussed by the authors.

Sub-section:	8.1 General Impacts
Page #:	62
Title:	
Paragraph:	4
Sentence:	Last
Statement:	*Given the transport behavior of MTBE, these concentrations will likely increase in the future.*
Comment:	The reason why MTBE concentrations will increase in the future should be stated. While a yet to be sampled release site may be found in the future to have a higher maximum value, the distribution of MTBE levels (considering all sites) may not change much from the sampled sites to date. We are not aware of any completed studies that show a mechanism to "concentrate" MTBE with time or distance from the source.

Sub-section: 8.1 General Impacts

Page #: 62

Title:

Paragraph: 1-5

Sentence: (all of 8.1)

Statement:

Comment: The assessment described in this chapter focused almost exclusively on ground water at LUFT sites and ground water supply wells. While these are two important aspects of California's ground water, the authors have not addressed MTBE impacts to the State's entire ground water resource. In aggregate, ground water contaminated by LUST sites represents a small fraction of California's ground-water resource. Also, the extent to which MTBE levels in PWS wells are diminished during blending (with water from other wells with no MTBE) or during treatment should be examined by the authors.

Sub-section: 9.0 Recommendations

Page #: 63

Title:

Paragraph:

Sentence:

Statement: *A statewide survey of California's groundwater quality should be performed. Groundwater samples from public and private wells should be collected and analyzed. A thorough scientific survey will provide information to document fully the extent of MTBE's impact on California's groundwater resources.*

Comment: The last paragraph of pg 64 describes a very important part of this assessment. How would the indicated research proceed? Do predictions made in this chapter need to be revisited based on further study?

Sub-section:	9.0
Page #:	64
Title:	
Paragraph:	3
Sentence:	
Statement:	*A statewide survey of California's groundwater quality should be performed. Groundwater samples from public and private wells should be collected and analyzed. A thorough scientific survey will provide information to document fully the extent of MTBE's impact on California's groundwater resources.*
Comment:	The proposed study should consider characterizing the quality of California's major aquifers regardless of their current use for drinking water. Also, the sampling of PWS wells should be expanded to also include analyses of drinking water itself—to understand the effect(s) of blending and treatment, and to better characterize the exposure level from drinking water.

Sub-section:	1.10 References
Page #:	65
Title:	
Paragraph:	Title
Sentence:	l
Statement:	*1.10 References*
Comment:	Should this section be numbered 10.1, not 1.10? Same goes for the contents page.

Sub-section: 1.10 References

Page #: 65

Title:

Paragraph: 2

Sentence:

Statement: *Boughton, C.J., and M.S. Lico, 1998, Volatile organic compounds in Lake Tahoe, Nevada and California, USGS Fact Sheet FS-055-98, July-September 1997.*

Comment: The "July-September, 1997" should be part of the title, not at the end of the reference as written. Date published is June, 1998. The correct title for the citation is:

> Boughton, C.J., and M.S. Lico, 1998, Volatile organic compounds in Lake Tahoe, July-September 1997: USGS Fact Sheet FS-055-98, 4 p.

Sub-section: Appendix H

Page #: 94

Title:

Paragraph:

Sentence:

Statement: …

Comment: There is probably considerable uncertainty in the lengths of the BTEX plumes from the Happel study because of the difficulty in separating the source (i.e., the zone containing smeared NAPL) from the dissolved-only phase plume. Consequently, there is a good chance that the actual dissolved portions of the BTEX plumes are even shorter than reported. It is unclear exactly what the implications of this might be for fitting the BTEX data and for the subsequent extrapolation of MTBE plume length.

Modeling BTEX disappearance as a first-order process approximates field-scale behavior, but probably is not that good a model of the substrate-limited degradation process. It is unclear what impact, if any, the 1st order model might have on the fitting of parameters and upon MTBE plume length extrapolation.

The report should discuss the implications of uncertainties associated with BTEX plume length and their relation to MTBE plume length.

The report should also discuss the implications of assuming a first order degradation rate and add a discussion regarding persistence of MTBE in anoxic aquifers.

Sub-section: Appendix H

Page #: 97

Title:

Paragraph:

Sentence:

Statement: …

Comment: The simulations used an apparently low and constant value for the MTBE source concentration. These assumptions may not be representative of real conditions. The source concentration used may be low (e.g., the "most likely value" for the simulations was 1.8 mg/L), although the values used are generally consistent with field measured values for plumes. However, source strength can vary markedly and some point source measurements within or just down-gradient from sources can give concentrations 2-20 times higher than the values used for the source concentration in the model. On the other hand, because the concentration is set as a constant throughout the simulations, it will not drop off as a function of time and thus the model may over-estimate concentrations coming from a "weathered" source. Unfortunately there are few MTBE data to allow a more accurate description of the MTBE source concentration and how it changes with time. This lack of knowledge of MTBE source information may cause significant uncertainty in the model's projections.

The report should discuss the implications of the source function used for these simulations and how higher concentrations and/or decreasing source functions would impact MTBE plume length.

Sub-section: General Comment

Page #:

Title:

Paragraph:

Sentence:

Statement:

Comment: The section of Chapter IV on "State Wide Data Base for MTBE in Surface Drinking Water Supplies could be enhanced by:

- increasing the number of reservoirs with MTBE data;
- providing information on reporting levels;
- providing information on when MTBE detections were found and the relation to seasonal boat use; and
- providing information on when detections >5 and 14 ug/L occurred.

It is noteworthy that some reservoirs have extensive data sets (Lake Havasu, Casitas Res, Lake Castaic, Lake Perris, Lake Skinner, Silverwood Lake and others) and these data were not discussed in detail. A more thorough interpretation of these data sets could be completed to assess probable sources, seasonal trends, relation to watercraft use, year-end carryover, migration to hypolimnion, effect of inflows and withdrawals, and so forth. It seems that these data sets have the potential of broadening the understanding of the behavior and fate of MTBE—above and beyond the excellent discussion for Donner Lake.

This section of the report did not seem to reach any definitive conclusions (except for Donner Lake).

There seems to be a need to do a more coordinated sampling of select reservoirs that cover a range of conditions of interest. Common field and lab protocols are essential. This may be more productive in terms of identifying important natural and anthropogenic factors than the approach of continuing to build the state-wide data base from varied water utility monitoring.

Sub-section title: 2.0 State-Wide Database for MTBE in Surface Drinking Water Supplies

Page #: 3

Paragraph:

Sentence:

Statement:

Comment: There should be some explanation of what constitutes a "region" and of the significance of water transfers for regional affiliation. For example, Hetch-Hetchy and other Sierra reservoirs are listed under the San Francisco region (page 9). This is justifiable given where the water is used, but incorrect based strictly on location. A map of the CAL-DHS regions should be included for reference here and possibly in other places in the report where appropriate (such as the Summary in Volume I, section 5.1, page 29). Also, the three-letter codes for regions (for example, LAS, SHA ...) should be explained in table 1.

Sub-section: 3.6 List of Figures

Page #: 36

Title:

Paragraph:

Sentence:

Statement:

Comment: The caption for figure D-C (first sentence) should be revised. The authors might consider a revised sentence such as “MTBE concentrations in Donner Lake on each of the sampling dates…”. The inclusion of 0.1 ug/L should be clarified. Is this the MRL?

Sub-section:	4.1 Surface Water
Page #:	41
Title:	
Paragraph:	2 & 3
Sentence:	all
Statement:	· *MTBE concentrations in Lake Tahoe were higher in areas of boating activity (3 m depth). In early September, measured values from these areas ranged from 0.30 to 4.2 ug/L (ppb) with a mean of 1.3 ± 1.3 ug/L (±SD).* · *MTBE from the same depth but* in the open-water was less at 0.51±0.12 ug/L.
Comment	The authors should consider removing the mean concentrations from these 2 statements because water-quality data are typically not normally distributed. Also, the open-water data set consists of only 2 measurements. Providing the range of measured values (rather than the mean) is suggested.

Sub-section:	4.1
Page #:	41
Title:	
Paragraph:	7 (last)
Sentence:	4
Statement:	*Offshore from Ski Run Marina (a jet ski storage area), concentrations were high exceeding 20 ug/L in both July and September*.
Comment	The authors should consider changing "jet ski" to personal watercraft (PWC). Note: This comment also applies to page 42, top sentence.

Sub-section:	4.3 Groundwater
Page #:	
Title:	
Paragraph:	1
Sentence:	last 2
Statement:	*Over the Labor Day weekend in 1997 the MTBE level in dry deposition near the lakeshore was less than 0.1 ug/L limit of detection. During the 4th of July weekend in 1998, concentrations in dry deposition were above detection, albeit low, near the lakeshore (0.15 ug/L) but again below detection in the open water portion of the lake.*
Comment:	In last part of the paragraph, reference is made to MTBE in dry deposition and it being < 0.1 ug/L. Typically, dry deposition is reported in some weight/weight measure, such as ug/kg. "Precipitation scavenging" may be a better term than deposition.

Sub-section:	4.3 Groundwater
Page #:	44
Title:	
Paragraph:	2
Sentence:	3rd to last
Statement:	*The South Lake Tahoe Public Utility District reports that 11 drinking water wells have been closed because of MTBE contamination*.
Comment:	This sentence makes it sound as if all 11 wells were shut down because they were contaminated. Suggest checking the accuracy of this statement. It is our understanding that only 8 of 11 wells were shut down because of contamination.

Sub-section:	4.3
Page #:	45
Title:	
Paragraph:	
Sentence:	1
Statement:	*… Using the assumption that regional horizontal groundwater velocities away from wells are on the order of 100 feet per year (Jim Trask, Department of Land, Air and Water Resources, C Davis pers. comm.), these sources may directly impact surface waters within 8-20 years*.
Comment:	Consider rewording this sentence to read: "Using the assumption that regional horizontal ground-water velocities outside the influence of pumping wells are…". The use of the phrase "away from wells" does not convey the exact intended meaning.

Sub-section:

Page #: 46, Figure T-1

Title:

Paragraph:

Sentence:

Statement:

Comment: MTBE values for October-June appear on Figure T-1 to be equal to 0.1 ug/L, not <0.1 ug/L as stated in the text. Should denote the <0.1 ug/L somehow on Figure T-1.

Sub-section title: I. Introduction

Page #: 1

Paragraph: 1

Sentence: entire paragraph, especially the last 2 sentences

Statement: *Due to its low cost, ease of production, and favorable transfer and blending characteristics it is currently the second most manufacture organic chemical in the U.S., almost all of which is used as a gasoline additive (Squillace et al., 1995). In 1993 over 24 billion pounds of MTBE, worth over $3 billion, were produced.*

Comment: The 1995 citation of Squillace is somewhat dated information. The reviewers were unable to verify the 24 billion pounds value. A more recent estimate (than the 12,230 million pounds of MTBE produced in 1993) reported by the Chemical Manufacturers Association (1997)) of MTBE production is provided by Zogorski et al. (1998), which is cited in other chapters of the CA assessment. Zogorski et al. notes that about 350 billion liters of MTBE were produced in the U.S. in 1997.

> Reference: Zogorski et al., 1998, "MTBE: Summary of Findings and Research of the U.S. Geological Survey", Proceedings of 1998 annual conference of American Water Works Association, Volume D, Water Quality, pp 287-309.

The reference for the 1997 production value from Zogorski et al. 1998 is:

> Department of Energy, 1998, Petroleum Supply Monthly: Tables B1-B4: Digital Data Files at URL:
>
> ftp://ftp.eia.doe.gov/pub/oil_gas/petroleum/data_publications/monthly_oxygenate_report/historical/1998/

Information from the Chemical Manufacturers Association reported in 1997 indicates that in 1996 MTBE was the 4th largest produced organic chemical behind ethylene, propylene, and ethylene dichloride.

> Reference: Chemical Manufacturers Association, 1997, U.S. Chemical Industry Statistical Handbook, 1997: Chemical Manufacturers Associations, Inc., Arlington, VA , 185 p.

Sub-section title: I. Introduction

Page #: 1

Paragraph: 5

Sentence:

Statement: *Although MTBE may be transported through precipitation and dry fallout, by far the largest source for surface waters is through the use of gas powered, aquatic recreational vehicles, specifically two stroke engine personal watercraft such as jet skis (Juttner et al., 1995; Reuter, 1998; Malcolm-Pirnie, 1998). These devices release approximately 25% of their fuel directly into the water, unburned.*

Comment: All engines used in watercraft do not emit the same percentage of unburned fuel. Representing this single value (i.e. 25%) in this manner is misleading, and also contradicts what is stated elsewhere in the report**.**

Two cycle engines can release from 4% to more than 50% of uncombusted fuel and oil mixture to the water (Juttner et al., 1995; Reuter, 1998). Suggest the authors include this range information in their report.

Reference: Juttner, Friedrich, Diedrich Backhaus, Uwe Matthias, Ulf Essers, Rolf Greiner, and Bernd Mahr, 1995, Emissions of two- and four-stroke outboard engines – I. Quantification of gases and VOC: Wat. Res., vol.29, no. 8., pp. 1976-1982.

Reuter, J.E., B.C. Allen, R.C. Richards, J.F. Pankow, C.R. Goldman, R.L. Scholl, and R.S. Seyfried, 1998, Concentrations, sources, and fate of the gasoline oxygenate methyl tert-butly ether (MTBE) in a multiple-use lake: Eniron. Sci. Technol., vol. 32, no. 23, pp. 3666-3672.

Sub-section title: I. Introduction

Page #: 1

Paragraph: 2

Sentence: 1st 2 sentences

Statement: *The MTBE content of gasoline can range from 5% to 15%. In California, MTBE has been added to gasoline every winter between 1992 and 1996, and year-round since 1996 (Malcolm-Pirnie, 1998)*.

Comment: Analysis of gasoline done as part of Motor Gas Surveys for Bakersfield, Los Angeles, San Diego, and San Francisco Bay Area from Winter 1990-1991 to summer 1997 shows that the mean level of MTBE in gasoline ranged from 0.0% to 14.0%. The Motor Gas Surveys also show extensive use of MTBE in gasoline (7-11% by volume, mean values) in winter 1994-95 in all 4 cities, and in summer 1995 in Los Angeles and San Diego.

Reference: Cheryl L. Dickson, National Institute for Petroleum and Energy Research, Bartlesville, OK (Summer and Winter Motor Gasoline Surveys, 1991-present).

Sub-section title: I. Introduction

Page #: 3

Paragraph: 4

Sentence: 1, 3

Statement:

- *MTBE has an objectionable taste and odor, with a lower limit of about 20 ug/L for human detection in drinking water.*

- *Currently the EPA has developed a draft advisory concentration in drinking water of 20 to 200 ug/L while California has state action levels set at 35 ppb (Reuter, 1998).*

Comment: The USEPA has a more recent drinking water advisory of 20 – 40 ug/L based on aesthetic concerns (USEPA, 1997). CA-DHS proposed a secondary MCL (SMCL) for MTBE at 5 ug/L based on available data for the observable detection thresholds. The SMCL is set to maintain the aesthetic properties of drinking water (SEE VOLUME II. Human Health Effects).

Reference: USEPA, 1997, Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on MTBE. Fact Sheet 4 pp. and Advisory 42 p. EPA-822-F-97-009. Available at: http://www.epa.gov/oust/MTBE/index.html

Sub-section title:	2. Model Description; 2.1 Hydrodynamic model
Page #:	4, 5
Paragraph:	4
Sentence:	
Statement:	*The Froude number based on outflow, Fo, …*
Comment:	Need to define H from equation 4. Is H the withdrawal flow depth?

Sub-section title:	MTBE Model
Page #:	6
Paragraph:	1st paragraph after Equation 9
Sentence:	all
Statement:	*It should be noted that the variable h in Eqn (9) is the depth of the uppermost computational layer, typically less than 1 m thick in model simulations. It is to be distinguished from the limnological surface layer of the lake, which may have a depth of tens of meters, and is represented in the model as a combination of a number of computational layers.*
Comment:	Overall, this is a good model and will be useful as a research and policy tool. However, there is one important question concerning how McCord and Schadlow have parameterized gas transfer. In Equation 9, the characteristic depth for gas transfer should be the depth of the mixed layer, not the depth of the uppermost computational layer. Using the much thinner depth will allow the upper layer to equilibrate with the atmosphere much more rapidly than it should. This will artificially decrease the concentrations at the surface, as can be seen in several of the plots for MTBE in Figure 1 (note the slight decrease in MTBE concentration right at the water surface in Figures 1b, 1d, and 1f). This decrease in concentration will decrease the overall air-water flux because the MTBE concentration directly at the surface is underpredicted in the outgassing case during periods of no input. Thus, the model consistently overpredicts MTBE concentrations in the fall. Also, this section of the report is a little unclear on which layer the model uses for input of MTBE, but if the motorboat input of MTBE in the model is directly into the uppermost layer, the enhanced exchange would also account for why concentrations were consistently lower in the summertime when there are inputs. In this case, the MTBE in the top layer is allowed to equilibrate with the atmosphere faster than it is being mixed into the main portion of the epilimnion.

Sub-section: Introduction

Page #: 1

Title:

Paragraph: 1

Sentence: General note

Statement:

Comment: Suggest the authors include an explanation of why this probabilistic exposure assessment was conducted in addition to the deterministic assessment described in Section 2.5 of Volume II. There is little coordination/comparison between Section 2.5 and this section of the report, and they seem like independent efforts. It's not clear why the deterministic and probabilistic exposure assessments are in two different volumes of the report.

Sub-section: General Comments

Page #:

Title:

Paragraph:

Sentence:

Statement:

Comment: It is unclear why the analysis of human exposure to MTBE only considered drinking water as the source. The CA Air Resources Board has an extensive data set on MTBE levels in ambient air and MTBE is known to be present in ambient air in those metropolitan areas where MTBE is used in gasoline. It would seem that a more complete assessment of human exposure would include the inhalation exposure form ambient air as well as the MTBE added to air from the volatilization of MTBE in drinking water.

Sub-section:	Introduction
Page #:	1
Title:	
Paragraph	2
Sentence:	first
Statement:	*An analysis of exposure of humans to MTBE requires estimating the amount of the MTBE that contacts humans at the lungs, gastrointestinal tract, and skin surface during some specified period of time (U.S. EPA 1987).*
Comment:	USEPA (1987) is referred to as USEPA (1989) on page 11.

Sub-section:	Exposure Model
Page #:	2
Title:	
Paragraph	4
Sentence:	second
Statement:	*We used lognormal distribution for ingestion rate per unit body weight (Table 1) taken from McKone and Bogen (1992) which was determined from data compiled by the ICRP (ICRP 1975) and the U.S. EPA (U.S. EPA 1989).*
Comment:	Suggest defining first use of all acronyms including ICRP.

Sub-section:	Exposure Model
Page #:	3
Title:	
Paragraph	1
Sentence:	equation
Statement:	$=C_w\{[BR/BW] * ([Et_s * W_s * TE_s/VR_s] + [Et_b * W_s * TE_s/VR_b] + [ET_h * W_h * TE_h/VR_h])/(24\ hrs/d)\}$
Comment:	Suggest changing Et_s and Et_b to ET_s and ET_b.

Sub-section:	Exposure Model
Page #:	3
Title:	
Paragraph:	2
Sentence:	first
Statement:	*… where C_w is the concentration of MTBE in the tap water in mg/liter, BR/BW is breathing rate per unit body weight, ET_s is the exposure time in the shower in hours per day, W_s is the shower water use rate per person in liters per hour, ET_b is the exposure time in the bathroom in hours per day, W_h is the water use rate in the house in liters/hour, ET_h is the exposure time in the house in hours per day, VR_{rs} is the ventilation rate in the shower in m^3 per hour, VR_h is the ventilation in m^3 per hour, …*
Comment:	Suggest changing VR_{rs} to VR_s.

Sub-section:	Exposure Model
Page #:	3
Title:	
Paragraph	3 - Dermal Exposure
Sentence:	first
Statement:	*Dermal contact with MTBE occurs as a result of showering, bathing, and general washing.*
Comment:	Suggest the authors explain why dermal exposure was considered in this version of the exposure assessment when dermal exposure was explicitly not included in Volumes I and II.

Sub-section:	Results
Page #:	5
Title:	
Paragraph:	3
Sentence:	1st 2 sentences
Statement:	*A preliminary simulation of the exposure model was performed using the mean value of all the distributions as input parameters. This deterministic simulation was used to assess the general contributions of each exposure route to the total exposure.*
Comment:	It would be helpful to state the "mean value" for MTBE in drinking water that was used in the "General Exposure Model—Deterministic Analysis." This value could not be found in this chapter. Were actual California drinking-water analyses used to develop the distribution of MTBE levels used in the exposure analysis given in this chapter?

Sub-section:	Results
Page #:	5
Title:	
Paragraph:	4
Sentence:	first & third
Statement:	*Compared to a previous exposure analysis (OEHHA 1998), our relative exposures of inhalation and ingestion are somewhat different…. At high levels of water intake, ingestion of MTBE was approximately twice the inhalation exposure (OEHHA 1998, Table 16).*
Comment:	The reference cited (OEHHA 1998) is not listed in the reference section.

Section # and Title:	1. Exposure of Humans to MTBE from Drinking Water
Sub-section:	Results
Page #:	7
Title:	
Paragraph:	2
Sentence:	last
Statement:	*Model II was run as before using the model-generated distribution of MTBE concentrations with a mean of 9 ppb.*
Comment:	Suggest the authors explain why a value of 9 ppb was used.

Sub-section:	Additional Exposure Scenarios
Page #:	8
Title:	
Paragraph	1
Sentence:	1
Statement:	*For the exposure analysis due to consumption of contaminated fish, we followed the Oregon Department of Environmental Quality guidelines and made the following assumptions (1) all fish consumed originated in a lake contaminated with MTBE, (2) the fish spent all of their time in the upper portions of the lake…*
Comment:	Suggest the authors include a citation in this sentence as follows: "..Environmental Quality guidelines (ODEQ, 1997) and made.."

Sub-section:	Discussion
Page #:	9
Title:	
Paragraph	2
Sentence:	second
Statement:	*This level coincides with the proposed secondary standard for taste and odor.*
Comment:	The information in this section is not consistent with Section 2.5.10. Section 2.5.10 indicates that the secondary standard for taste and odor is 35 ug/L. Here the authors use 5 ug/L.

Sub-section:	Literature Cited
Page #:	11
Title:	
Paragraph	2, 3, 9
Sentence:	all
Statement:	*Brown, S.L. 1997. Atmospheric and potable water exposures to methyl tert-butyl ether (MTBE). Regulatory Toxicology and Pharmacology 25:256-276.* *California Environmental Protection Agency (Cal EPA). 1998. Draft Public Health Goal for Methyl Tertiary Butyl Ether (MTBE) in Drinking Water. Pesticide and Environmental Toxicology Section, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA.* *U.S. Environmental Protection Agency (U.S. EPA). 1989. Exposure Factors Handbook. Report No. EPA/600/8-89/043. Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Washington, DC.*
Comment:	Two references are not cited in the text (Brown, 1997 and CalEPA, 1998). USEPA (1989) is cited as USEPA (1987) on page 1. Suggest the authors verify the use of these references in the narrative text.

Sub-section title: Entire section

Paragraph:

Sentence:

Statement:

Comment: Another management alternative that the authors may consider is non-oxygenated boating fuel. The major benefit derived from oxygenated gasoline is in its use in automobiles, however, because there is no separate gasoline formulation, oxygenated gasoline is used in watercraft across California. It is understood that fuel will be routinely introduced to water just by operating gasoline-powered watercraft and two-cycle personal watercraft. Did the authors consider the cost benefit associated with the distribution and use of non-oxygenated fuel for boating only? The problem seems to be with the gasoline not the recreational boating practices.

The authors should also consider an additional exposure pathway, namely lake/well interaction. Are the lake shores in California populated and do these residents use wells for water supply? The combination of maintained water levels and clustered wells may make it feasible that such wells may be fed, in part, by lakes. This type of land use is common in northern New Jersey.

Sub-section:	Executive Summary
Page #:	4 & 5; 18
Title:	
Paragraph:	pg 4 - last & pg 5 top
Sentence:	last and continued on top of pg 5
Statement:	*MTBE concentration of surface and groundwater (in ppb) with and without proposed policies are compared to the EPA proposed secondary standard of 5 ppb and rated based on likelihood of exceeding this proposed standard.*
Comment:	The statement refers to “EPA’s proposed secondary standard of 5 ppb”. It would be helpful to denote this as “CALEPA” so as not to confuse California’s proposed standard with the USEPA advisory of 20-40 μg/L.

Sub-section:	
Page #:	6
Title:	
Paragraph	1
Sentence:	3
Statement:	*The refineries gain large economically from using MTBE as an oxygenate, since MTBE can be produced from refinery process byproduct (Chang and Last, in press 1998).*
Comment:	This statement seems to be a contradiction. Elsewhere in the report it is stated that it is more costly to produce MTBE.

Sub-section:	Current Concerns
Page #:	7
Title:	
Paragraph:	1
Sentence:	last
Statement:	*In California, … Santa Monica, South Lake Tahoe, and San Francisco (Wiley, 1998)*
Comment:	The reference for Wiley (1998) is not included in the list of references.

Sub-section:	MTBE in Air
Page #:	10
Title:	
Paragraph:	1
Sentence:	last
Statement:	*In urban areas, along roadsides, MTBE was detected at average concentration ranging between 0.025 and 8.4 ppb (Squillace, 1995).*
Comment:	The article by Squillace et al. (1995) does not discuss levels of MTBE in air. The source for the concentration statement, "MTBE concentration levels… between 0.025 and 8.4 ppb" is unknown to the reviewers.

Sub-section:	MTBE in Surface Water
Page #:	10
Title:	
Paragraph:	2
Sentence:	2 & 3
Statement:	*Precipitation and stormwater in urban areas, where cars use gasoline with MTBE, does not appear to be a significant source of MTBE in surface water or groundwater. A monitoring study by the USGS of 592 locations in 16 cities and metropolitan areas around the United States found MTBE concentration levels ranging from 0.2 to 8.7 ppb with a median of 1.5 ppb in 6.9% of sampled stormwater (Delzer, G.C. et al, 1996).*
Comment:	While precipitation and stormwater may not be very important in terms of total mass (or concentrations) to natural waters, they certainly are important for explaining the frequency of detection and ubiquity of MTBE in the urban environment.

Sub-section:	MTBE in Surface Water
Page #:	10
Title:	
Paragraph:	2
Sentence:	2 & 3

Statement: *Precipitation and stormwater in urban areas, where cars use gasoline with MTBE, does not appear to be a significant source of MTBE in surface water or groundwater. A monitoring study by the U.S.G.S. of 592 locations in 16 cities and metropolitan areas around the United States found MTBE concentration levels ranging from 0.2 to 8.7 ppb with a median of 1.5 ppb in 6.9% of sampled stormwater (Delzer, G.C. et al, 1996).*

Comment: As noted in the Delzer et al. (1996) only 3 of the 16 cities used high levels of MTBE in gasoline during the time period of USGS sampling. The use of MTBE in these 3 cities was for carbon monoxide (CO) abatement. The levels of MTBE in stormwater in areas of the U.S. that extensively use MTBE in reformulated gasoline has not been reported in the literature. As such, the significance of stormwater as a source of MTBE in RFG areas of the U.S. is not known.

Sub-section:	MTBE in Surface Water
Page #:	11
Title:	
Paragraph:	1
Sentence:	All

Statement: *Other sources of high MTBE concentration in surface water are accidental spills from trucks transporting fuel, marina gasoline storage tanks, and refineries located along the cost (Cal/EPA, 1997). Accidental spills are reported to National Response Center of the US Coast Guard who maintains the Marine Spill Information System (MSIS). Overall spills of gasoline are very small volumes, compared with other releases. Since information on MTBE concentrations is sporadic and lacking and due to the random nature of spills, it is difficult to incorporate the impacts of accidental spills into an analysis.*

Comment: While incidental spills of gasoline may be small (1-20 gallons, etc.) there is evidence that such small release (from car accidents and homeowners) can cause exceedences of MTBE drinking water standards in drinking water provided from ground water. The recent study by the State of Maine cites the probable importance of small spills of RFG containing MTBE on domestic wells.

Reference: State of Maine, 1998, The presence of MTBE and other gasoline compounds in Maine's drinking water: A preliminary report October 13, 1998; prepared by Maine Department of Human Services; Bureau of Health, Maine Department of Environmental Protection, Bureau of Waste Management and Remediation; Department of Conservation, Maine Geological Survey, 15 p.+ attachments.

Sub-section:	2. Lake supplied public drinking water
Page #:	14 & 15
Title:	
Paragraph:	Entire Section
Sentence:	
Statement:	
Comment:	An option that is not considered in the analysis of this section is to divert a portion, or all of the inflow directly to the water treatment plant. This could be done during critical time periods only or as a percent of the water demand yearly. Although not discussed in the chapter, it is presumed that the imported water to California's reservoirs is free of MTBE or has very low levels. Diversions around extensively used reservoirs (like Lake Perris) may prove to be cost effective in certain situations.

Sub-section:	Exposure Scenarios for Evaluation, 3. Groundwater supplied public drinking water
Page #:	15
Title:	
Paragraph:	1
Sentence:	1
Statement:	*"Groundwater makes up approximately 53% by volume of public water supply, serving 13.6 million people in California (USGS, 1990)."*
Comment:	Ground water use varies annually, as well as spatially, in California due to a large reliance upon surface water reservoirs and the effects of annual precipitation totals and distributions. The estimated 100,000 acre-ft of ground water that may possibly be impacted would represent less than 3 percent of the total 3,654,000 acre-ft (3,260 Mgal/d) of ground water and about 1.7 percent of the total water (5,830 Mgal/d) withdrawn for public supply use in California in 1990. Suggest the authors revise the abovenoted statement (sentence 1, paragraph 1) to reflect 1990 statistics reported by the USGS in 1993 as follows: "In 1990, ground water made up approximately 56% of the water withdrawals for public supply, serving about 13.6 million people, in California (Solley and others, 1993, p. 25)." Water-use statistics for 1995 (Solley and others, 1998) which were unavailable at the time the University of California study was conducted, are now available and could be used. Using these more recent statistics, the abovenoted statement would read: "In 1995, ground water made up approximately 49% of the water withdrawals for public supply, serving about 13.0 million people, in California (Solley and others, 1998, p. 23)." The most recent USGS water-use report can be obtained from our California District office in Sacramento. ***(Comment continued on next page)***

Comment (cont.): It might be easier for others to find the USGS publication source for the data the authors cited if the following reference citations are used:

Solley, W.B., Pierce, R.R., and Perlman, H.A., 1993, Estimated use of water in the United States in 1990: U.S. Geological Survey Circular 1081, 76p.

Solley, W.B., Pierce, R.R., and Perlman, H.A., 1998, Estimated use of water in the United States in 1995: U.S. Geological Survey Circular 1200, 71p.

Sub-section:	Exposure Scenarios for Evaluation, 4. Diversified public drinking water
Page #:	16-17
Title:	
Paragraph:	last-top
Sentence:	1,2,3,4 & 5
Statement:	"*Public supply from groundwater and surface water serves the majority of California's population. In California, public suppliers serve 25.5 million people. Total public supply in California by volume is almost equally divided between groundwater (53%) and surface water (47%)(USGS, 1990). The allotment of groundwater and surface water varies by region. In the South Coast region of California, served by Metropolitan Water District, 25% of the public water supply is groundwater whereas, in the Central Coast region, 82% of public water supplies are groundwater (DWR, 1994).*"
Comment:	Suggest the authors revise the abovenoted statement to something like: "In 1995, about 95 percent of California's 32 million people were served either surface water, ground water, or a blend by public water suppliers. The other 5 percent were self-supplied primarily from private wells. Estimated public supply withdrawals in 1995 were almost equally divided between ground water (49%) and surface water (51%) sources (Solley and others, 1998, p. 9, 23, and 27). The amount of ground water and surface water use varies annually and by region. About half of the water supplies for the South Coast region of California come from the Metropolitan Water District and only about 25% of the net water supplies were from local ground water sources at the 1990 and 1995 level of development. Whereas, net water supplies from local ground water in the Central Coast region, were estimated to be 82% at the 1990 level of development and 74% at the 1995 level of development (California Department of Water Resources, 1994, p. 94,100, 109, and 119, and 1998, p. 6E-2 and 6E-3)." ***(Comment continued on next page)***

Comment (cont.):

Reference: California Department of Water Resources, 1994, California water plan update: California Department of Water Resources Bulletin 160-93, Volume 2, 315p.

California Department of Water Resources, 1998, California water plan update: California Department of Water Resources Bulletin 160-98, Volume 2, 10 Chapters.

Solley, W.B., Pierce, R.R., and Perlman, H.A., 1998, Estimated use of water in the United States in 1995: U.S. Geological Survey Circular 1200, 71p.

Sub-section:	Exposure Scenarios for Evaluation, 5. Groundwater supplied rural household drinking water
Page #:	17
Title:	
Paragraph:	1
Sentence:	1
Statement:	*"4.28 million people in California rely on private wells, at an approximate total rate of 212 Mgal/d (USGS, 1990)."*
Comment:	Suggest the authors revise the abovenoted statement to something like: "The number of people who are self-supplied is probably decreasing in California every year. In 1990, 4.28 million people were estimated to have been supplying their own domestic water and in 1995 the estimate was down to 1.60 million people who were still self-supplied and primarily relying on ground-water sources. Estimated rates of self-supplied domestic ground-water withdrawals had similar declines from a total of 212 Mgal/d in 1990 to 108 Mgal/d in 1995 (Solley and others, 1993, p. 29, and 1998, p. 27)." Reference: Solley, W.B., Pierce, R.R., and Perlman, H.A., 1993, Estimated use of water in the United States in 1990: U.S. Geological Survey Circular 1081, 76p. Solley, W.B., Pierce, R.R., and Perlman, H.A., 1998, Estimated use of water in the United States in 1995: U.S. Geological Survey Circular 1200, 71p.

Sub-section:	5. Groundwater supplied rural household drinking water
Page #:	17
Title:	
Paragraph:	Last
Sentence:	all

Statement: *Based on data from the Department of Health Services, 35 public water systems have been identified to be contaminated with detectable concentrations of MTBE. This number of impacted wells constitutes 1.17% of all the public supply wells that were tested for MTBE and 0.27% of all public supply wells in counties where at least one well was tested. The 1.17% contamination represents high bound since it is based on testing done in areas suspected of contamination. The 0.27% represents a low bound for contamination in the state's public wells. Since there are no routine testing of private wells these bounds are used to estimate MTBE contamination in private wells. Of the 464,621 private wells reported in California during the 1990 United States Census, between 1,236 and 5,442 private wells may be contaminated with MTBE (Fogg, 1998). Since private wells are less likely than public wells to be near fuel storage tanks, the low bound of 1,236 contaminated wells is probably a more realistic estimate than the high bound of 5,442.*

Comment: Small gasoline spills from homeowners and car accidents should also be mentioned in addition to other sources already mentioned in the statement.

Sub-section:	5. Groundwater supplied rural household drinking water
Page #:	17
Title:	
Paragraph:	Last
Sentence:	6 & 7
Statement:	*Of the 464,621 private wells reported in California during the 1990 United States Census, between 1,236 and 5,442 private wells may be contaminated with MTBE (Fogg, 1998). Since private wells are less likely than public wells to be near fuel storage tanks, the low bound of 1,236 contaminated wells is probably a more realistic estimate than the high bound of 5,442.*
Comment:	The only comprehensive state-wide study of MTBE in domestic wells was recently reported by the State of Maine. This study found that the occurrence of MTBE in ground water did not correlate to the nearness of fuel storage tanks. As such, the statement concerning the "low bound . . . . a more realistic estimate that the high bound . . ." is not consistent with current knowledge about factors that relate to the occurrence of MTBE in domestic wells.

Sub-section:	
Page #:	28
Title:	
Paragraph:	top of page
Sentence:	6
Statement:	*Like MTBE, Ethanol behaves as a conservative solute, moving with water but unlike MTBE, ethanol is very biodegradable.*
Comment:	Ethanol does not behave as a conservative compound.... it is degraded (except possibly at very high levels). It does behave as a non-retarded compound.

Sub-section:	
Page #:	30
Title:	
Paragraph:	top of page
Sentence:	4
Statement:	*With these assumptions, the exposure during swimming is an order of magnitude lower than that for exposure to indoor water as shown in Figure 7 and is therefore not considered an exposure threat (1998).*
Comment:	Suggest the authors of the 1998 citation be added.

Sub-section:	2. Lake supplied public drinking water
Page #:	35
Title:	
Paragraph:	1
Sentence:	All
Statement:	*Currently Lake Perris water intake is operated to draw water from three different depths throughout the year to meet water temperature requirements (McCord, 1998). Modeling results shows that drawing from lower depths in the lake results in higher MTBE concentration in the water supply as shown in Figure 11. Higher MTBE levels in the lower depths of the lake may be explained by the mixing process of Lake Perris. As the lake, MTBE is drawn down and is trapped in the hypolimnion. Whereas MTBE at the surface tends to volatilize, MTBE in greater depth cannot escape through volatilization resulting in higher MTBE concentrations.*
Comment:	The authors appear to have misread Figure 11 which shows that elevated levels of MTBE in Lake Perris occur in the top of the reservoir—not the bottom.

Sub-section:	3. Groundwater supplied drinking water
Page #:	36
Title:	
Paragraph:	1
Sentence:	4
Statement:	*The tank replacement program does not appear to have significant impact in lowering probability of leaks to the groundwater (Couch and Young, 1998).*
Comment:	The above-noted statement does not agree with other chapters in the report. Tank replacement was stated elsewhere to reduce the probability of leaks to ground water.

Sub-section:	Comparison of Alternatives for the Scenarios, 5. Groundwater supplied rural household drinking water
Page #:	38
Title:	
Paragraph:	1; 2
Sentence:	2 ; 1&2 respectively
Statement:	*"In California, over 4 million people rely on private wells and draw at approximate rate of 212 Mgal/d."* *"There are 464,621 recorded private wells in California. Assuming each well supplies approximately 456 gallons/day (212 MGD/464,621 private wells) importing water would cost $300 annually for each well assuming infrastructure is available for distribution."*
Comment:	Suggest the authors revise the abovenoted statement to something like: "More than 4 million people were estimated to have been self-supplied for domestic water supplies in California during 1990, of which about 67% were estimated to be using ground water. In 1995 about 1.6 million people were estimated to still be self-supplied, with about 90% estimated to be using ground-water sources. In 1990, the total self-supplied ground water for domestic uses was estimated to be about 212 Mgal/d and by 1995 the estimate was down to about 108 Mgal/d (Solley and others, 1993, p. 29; 1998, p. 27)." The second statement is questionable, and at best needs to be revised to reflect the reduced estimate rate of ground-water use from 212 Mgal/d to 108 Mgal/d. What is the source of the estimate of 464,621 recorded private wells in California? Using the 1995 estimate of 108 Mgal/d for total domestic self-supplied ground water, each well would only supply about 232 gallons/day (108Mgal/d / 464,621 wells). This should effect your estimated treatment costs and the analysis of this alternative.

Sub-section:	Overall Policy Implication
Page #:	44
Title:	
Paragraph:	Table 9
Sentence:	
Statement:	*Ethanol oxygenated RFG = "0" Annual Cost* *Non-oxygenated RFG = "0" Annual Cost.*
Comment:	The analysis assumes there will be no cleanup cost associated with ethanol RFG or with non-oxygenated RFG), in comparison to conventional gasoline. The natural attenuation of gasoline plumes with high levels of ethanol is not well documented in the scientific literature. Also, a recent article by Corseuil and others (1998) suggests that ethanol may adversely influence the natural attenuation of benzene in ground water. Rather than entering zero annual cost it may be better to state that the cost of treating ethanol plumes is not known but requires future research, etc. The composition of CaRFG2 gasoline was not provided. Will it contain high levels of a specific compound that may alter the behavior and fate of benzene in gasoline releases to ground water? Until this is known the cost of treating releases CaRFG2 should be considered as unknown. Reference: Corseuil, H.X., Hunt, C.S., Dos Santos, R.C.F., and Alvarez, P.J.J., 1998, The influence of the gasoline oxygenate ethanol on aerobic and anaerobic BTX biodegradation: Water Research, vol. 32, no. 7, pp. 2065-2072.

Sub-section:	References
Page #:	4; 48
Title:	
Paragraph:	2; 4 respectively
Sentence:	
Statement:	*"Department of Water Resources (1994), California Water Plan Update, Volume 2." "US Geological Survey (1990), Estimated Use of Water in the United States in 1990*.
Comment:	The authors will probably want to modify their references to add the latest data from DWR and the USGS as follows: California Department of Water Resources, 1994, California water plan update: California Department of Water Resources Bulletin 160-93, Volume 2, 315p. California Department of Water Resources, 1998, California water plan update: California Department of Water Resources Bulletin 160-98, Volume 2, 10 Chapters. Solley, W.B., Pierce, R.R., and Perlman, H.A., 1993, Estimated use of water in the United States in 1990: U.S. Geological Survey Circular 1081, 76p. Solley, W.B., Pierce, R.R., and Perlman, H.A., 1998, Estimated use of water in the United States in 1995: U.S. Geological Survey Circular 1200, 71p.

Sub-section title:	1.3 Design Basis
Page #:	6
Paragraph:	2
Sentence:	1
Statement:	*Although USEPA has in effect a 35 ug/L advisory level, …*
Comment:	USEPA has a recent drinking water advisory of 20 – 40 ug/L based on consumer acceptance. The State of California has a drinking water interim action level of 35 ug/L. The authors should consider using CALEPA to distinguish their action level from the federal drinking water advisory.

Reference: USEPA, 1997, Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on MTBE. Fact Sheet 4 pp. and Advisory 42 p. EPA-822-F-97-009. Available at: http://www.epa.gov/oust/MTBE/index.html

Sub-section:

Page #: 1-7

Sentence:

Statement:

Comment: Results for air stripping and GAC systems presented in this section are similar to the results presented for the same technologies reviewed in Volume 5, number 3, entitled "Cost and performance evaluation of treatment technologies for MTBE-contaminated water." These two sections were reviewed to look for agreement or disagreement on similar issues. In some cases, costs presented for the same technology and parameters were not the same when both articles were compared. Suggest the authors of both chapters reach consensus on costs and related information, and a consistent set of information used in the report.